

USFS National Flow Gage

Gap Analysis - Region 3



Streamflow is extremely variable in the dryland rivers found in Arizona and New Mexico (Brown Canyon, AZ)



Prepared by

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Commissioned by
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Introduction

The purpose of this study is to review the location of stream gages across the region that are located on, or near, US National Forest System (NFS) lands, and to determine where there are gaps in the distribution of gages across the region.

Questions answered by this analysis include:

- What proportion of the lands in Region 3 are NFS lands?
- What is the extent of the stream network in the region?
- Where are the operational stream gages?
- Where have gages been discontinued?

Data presented in these slides were obtained from the following:

- **Streams:** stream layers (1:100K) were downloaded from the NHDPlus website:
<http://www.horizon-systems.com/nhdplus/data.php>
- **Gages:** 942 stream gage locations were downloaded from the USGS website:
<http://waterservices.usgs.gov/rest/Site-Test-Tool.html>

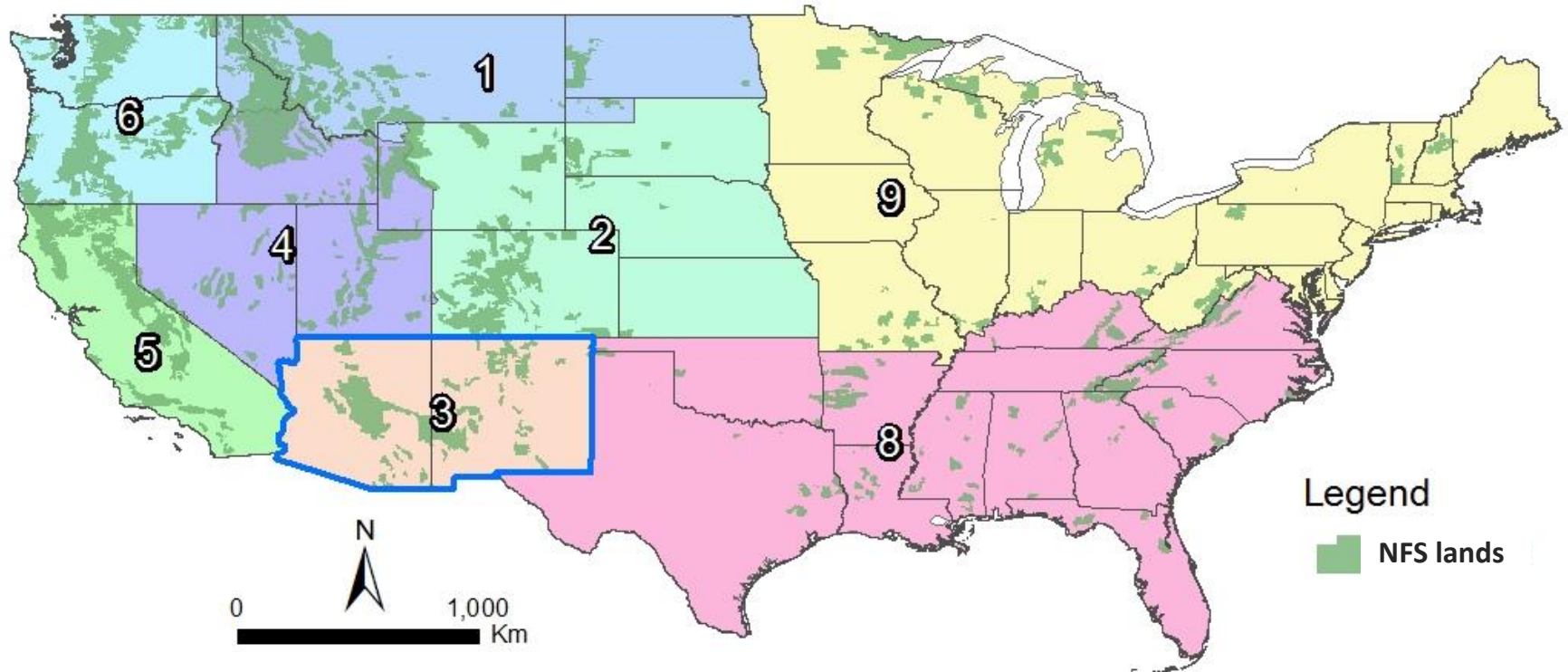
A note about the gage data:


Gage data were downloaded in winter 2014. We assumed that gages having no data beyond 12/31/09 were inactive and were labeled “Historic” in this analysis. Gages that had data past 1/1/10 were considered “Current” in the event their data had not yet been added to the website.

Summary Data

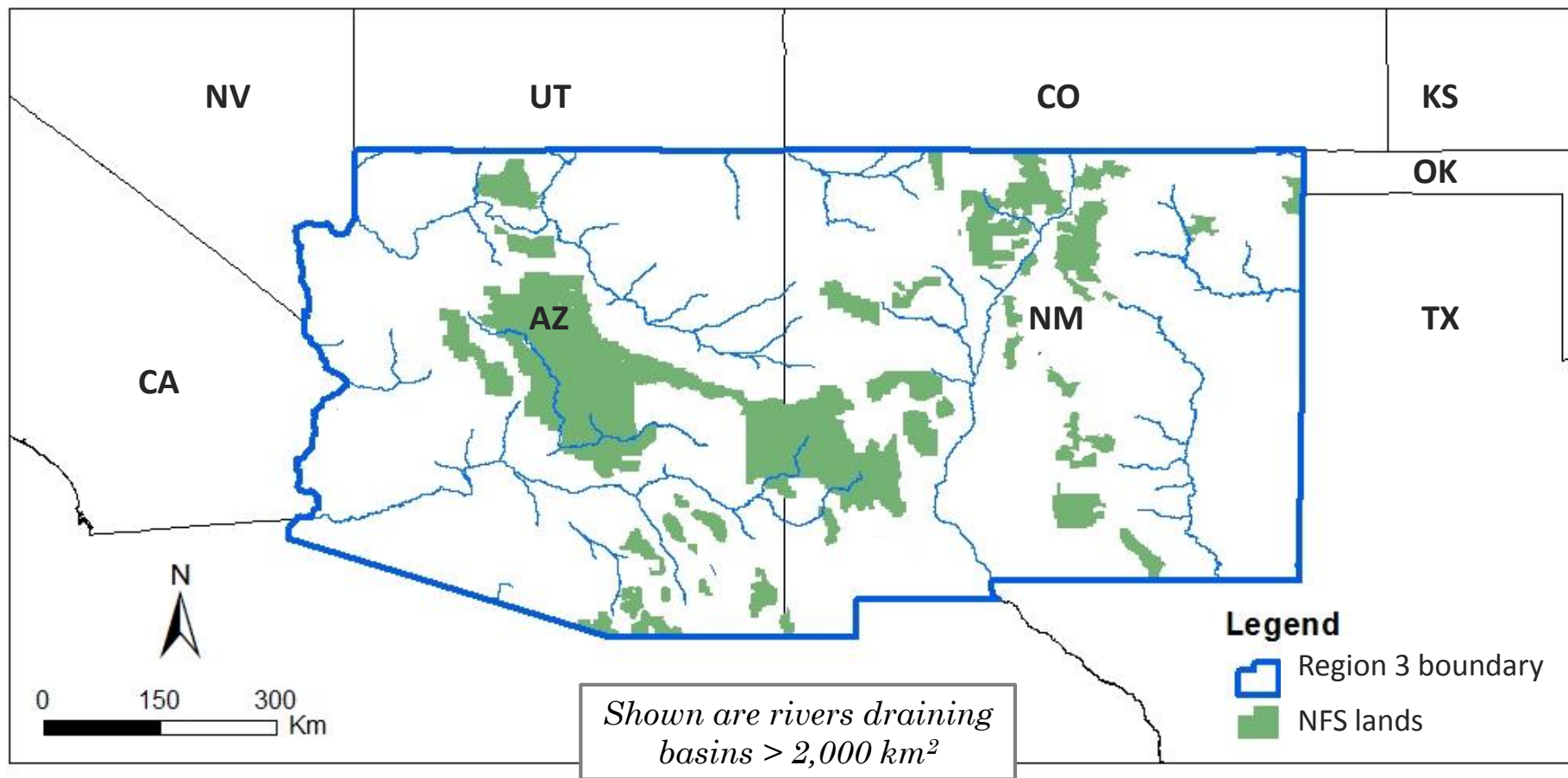
Attribute	On NFS lands in Region 3	All of Region 3	% NFS vs. Region 3
Land Area (Km ²)	90,361	609,707	14.8
Stream Length (km) (for basins > 4 km ²)	46,644	268,349	17.4
Number of Historic Gages	122	573	21.3
Number of Current Gages	60	365	16.4


USFS Regions in Lower 48



	NFS lands  in R3	All lands in R3	% NFS lands in R3
Area (km ²)	90,361	609,707	14.8

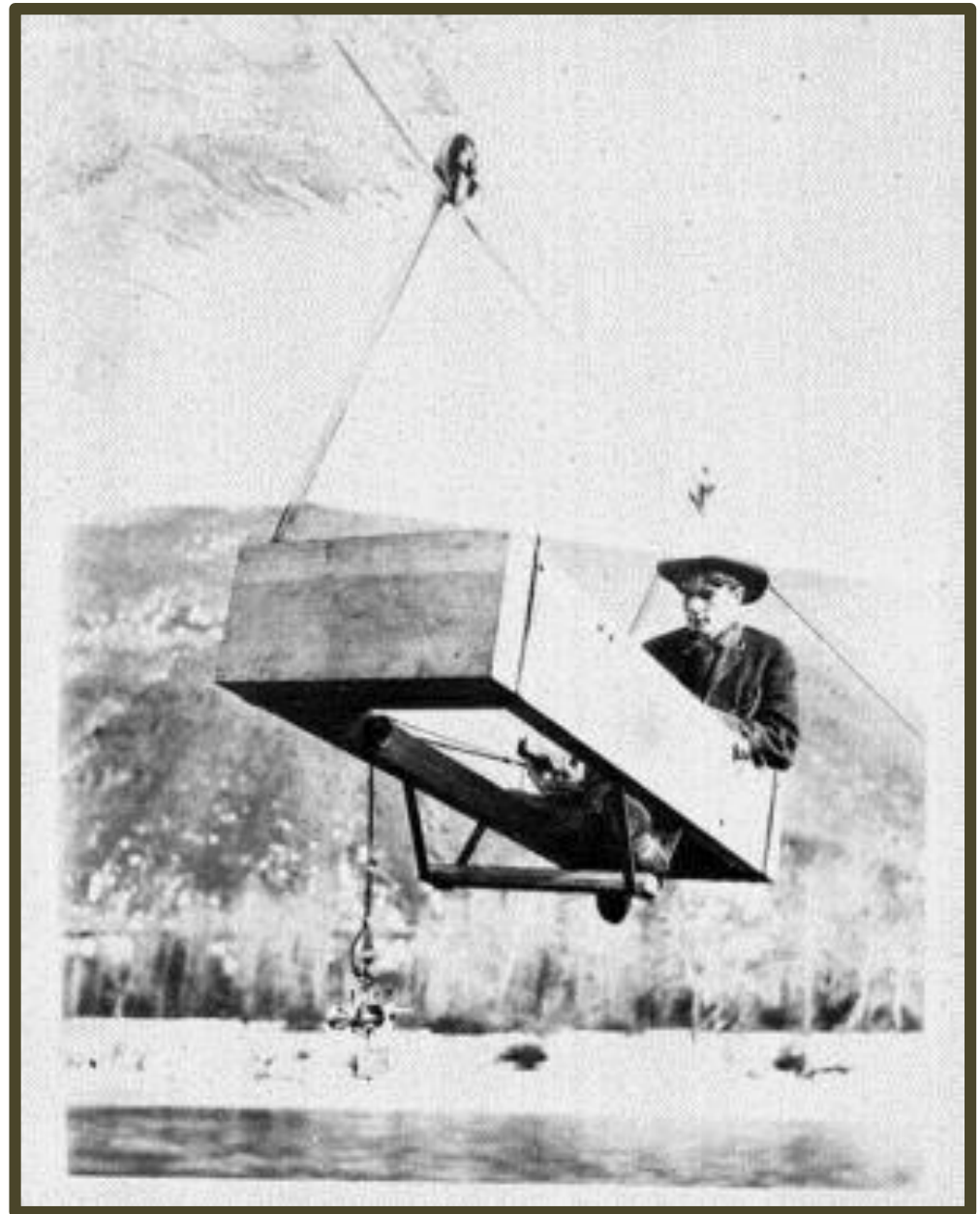
River Network in Region 3



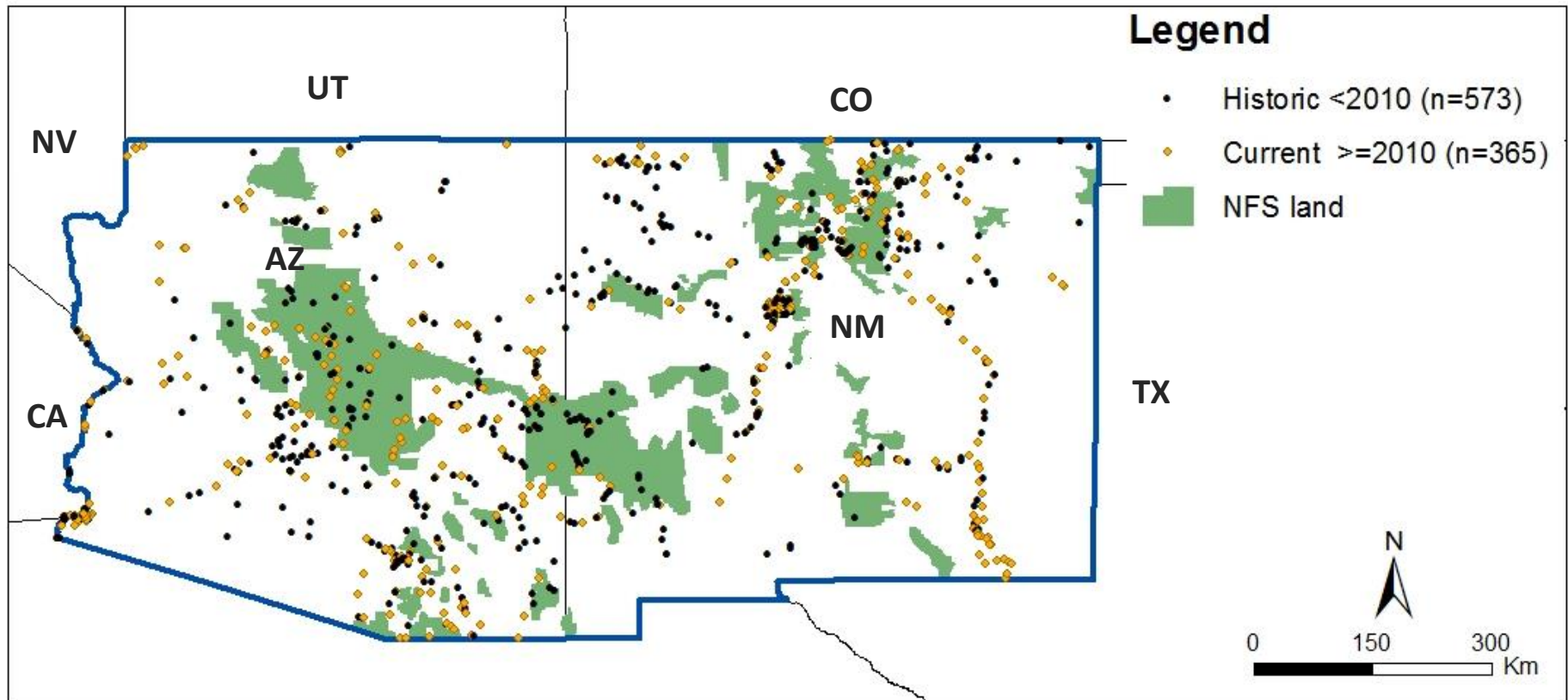
	NFS streams in R3 	All streams in R3	% NFS streams in R3
Stream Length (km) (for basins $> 4 \text{ km}^2$)	46,644	268,349	17.4

The following slides show
the location of
USGS gages
having discharge data
collected from
1912 - 2012

The gauging station on the Rio Grande near Embudo, New Mexico was the first USGS stream gauging station and was established by John Wesley Powell. Embudo was also the first USGS training center for hydrographers (circa 1888, USGS).

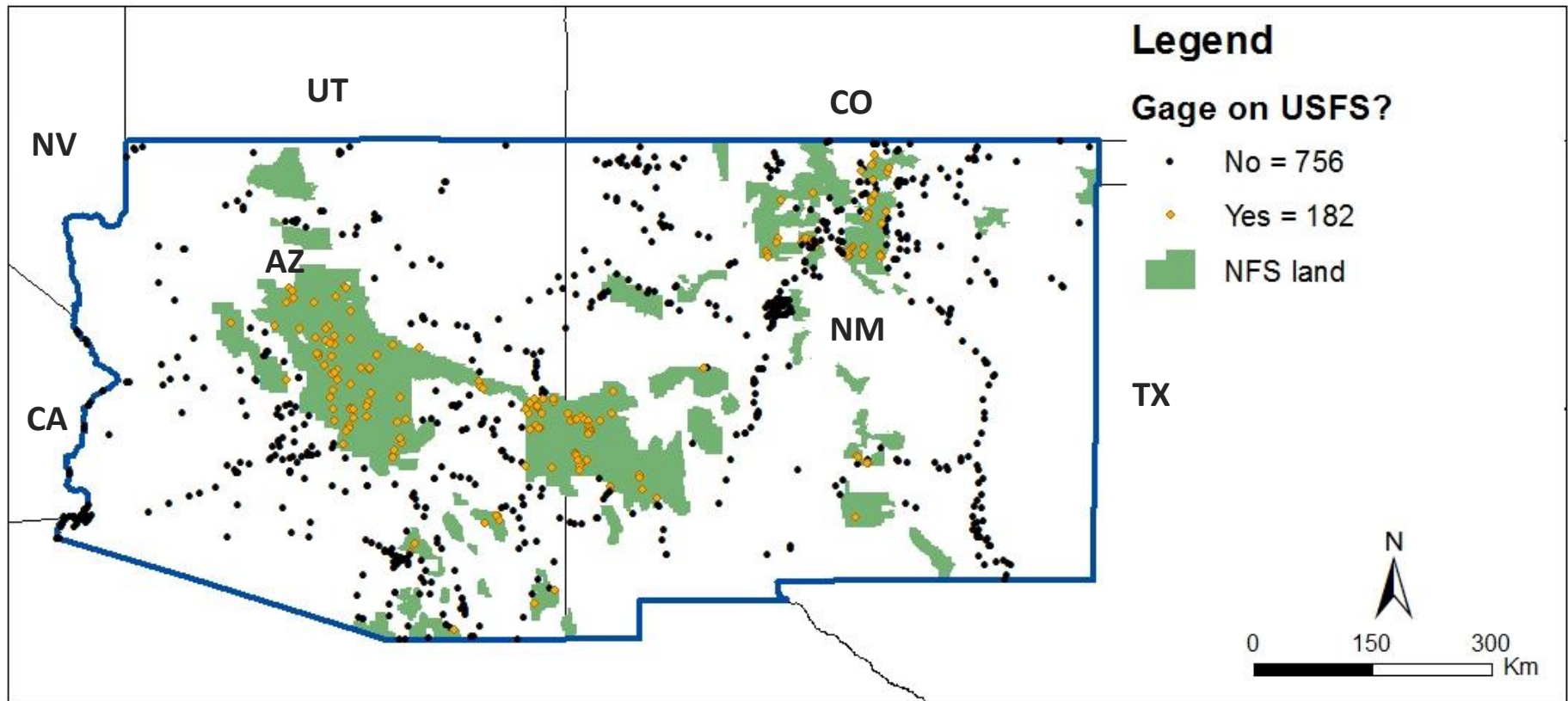


Historic and Current USGS Stream Gages from 1912 - 2012 (n=938)



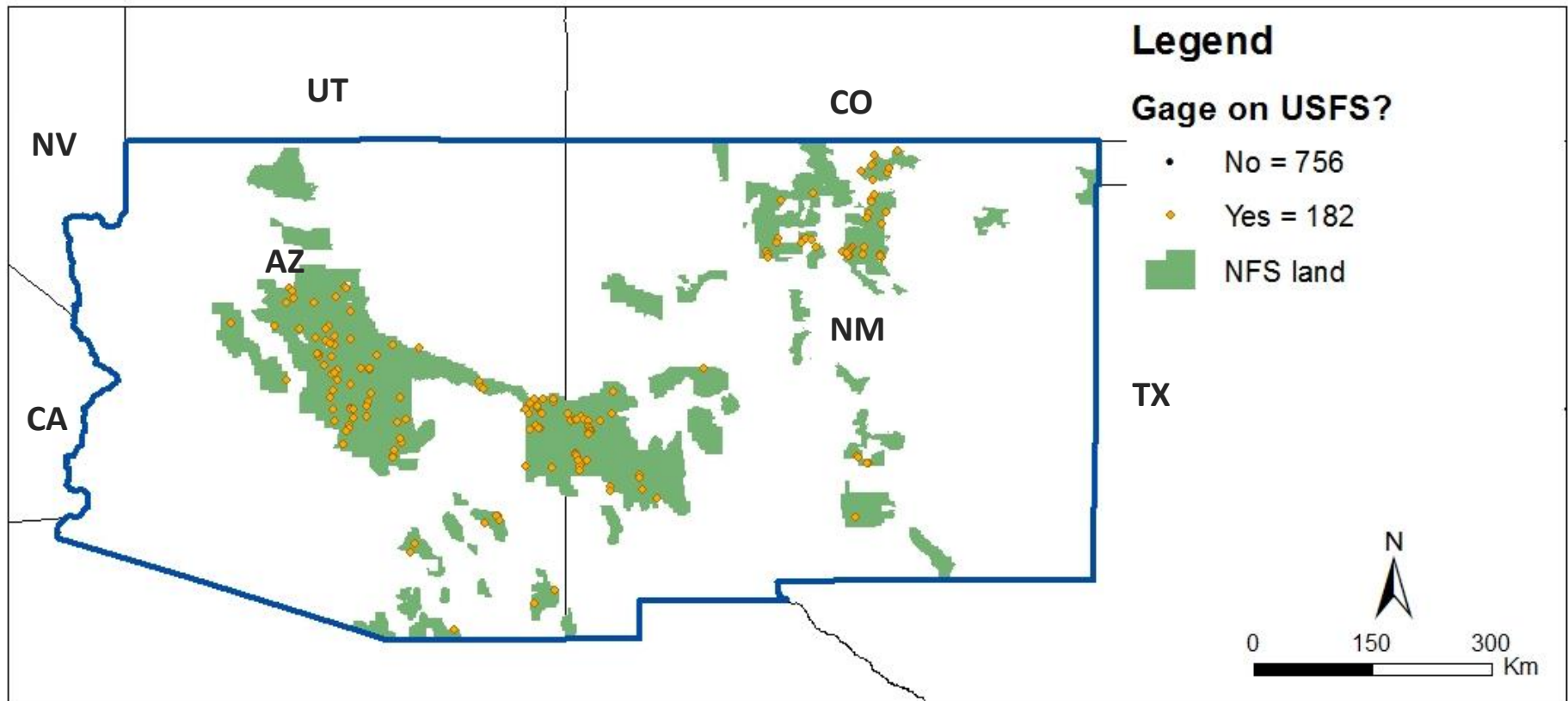
	Gages on NFS lands in R3	All gages in R3	% Gages on NFS lands in R3
Historic Gages	122	573	21.3
Current Gages	60	365	16.4

USGS Stream Gages from 1912 - 2012: Identifying those off and on NFS Lands



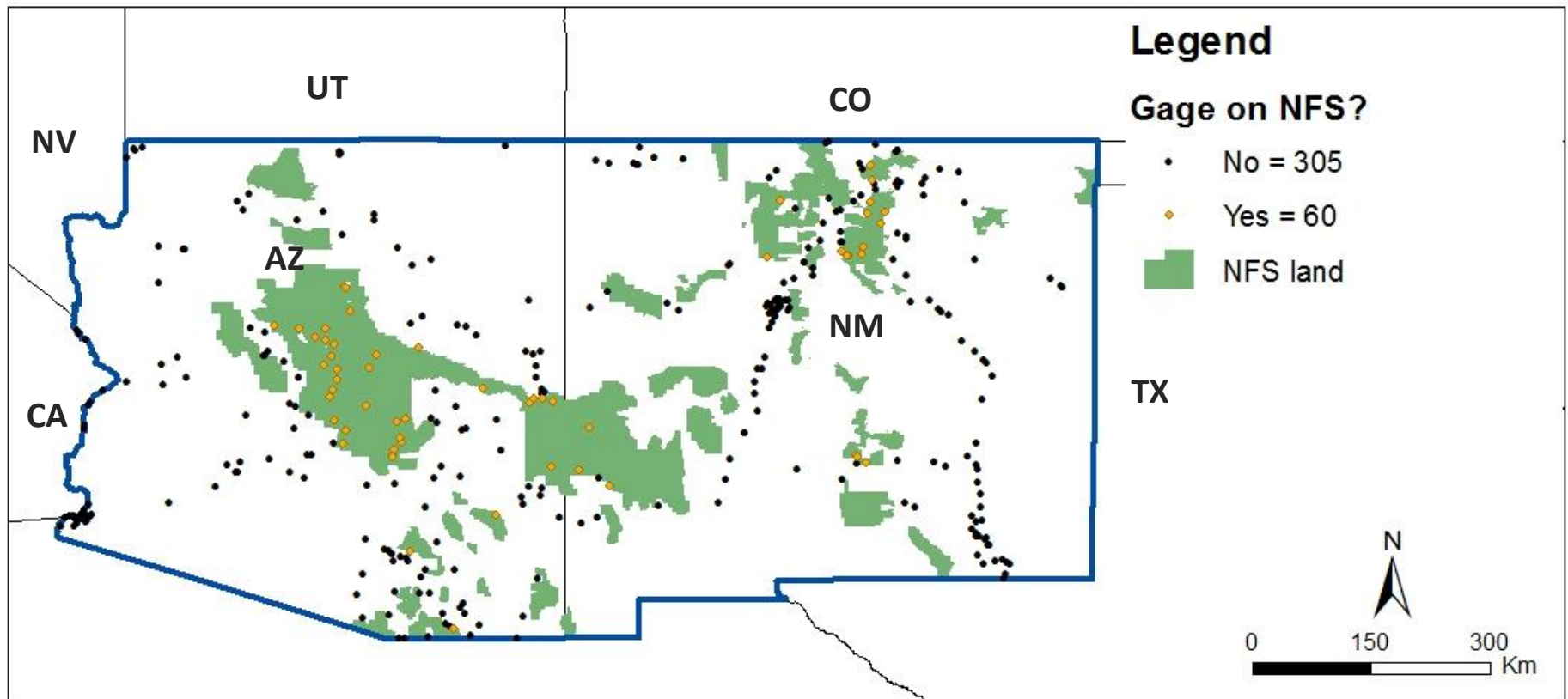
	Gages on NFS lands in R3	All gages in R3	% Gages on NFS lands in R3
Gages	182	938	19.4

USGS Stream Gages from 1912 - 2012: Only those on NFS Lands



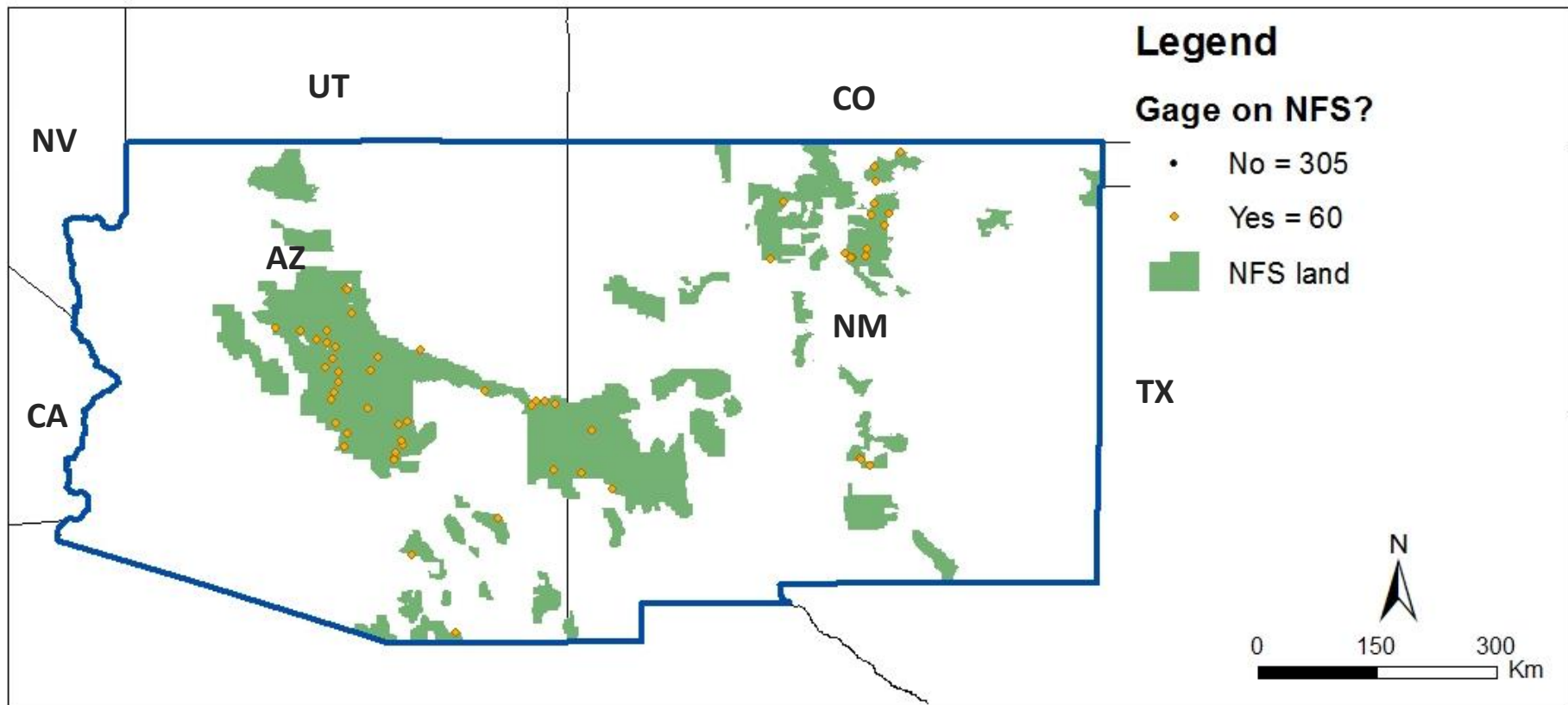
	Gages on NFS lands in R3	All gages in R3	% Gages on NFS lands in R3
Gages	182	938	19.4

USGS Stream Gages Currently Operational: Identifying those off and on NFS Lands



	Gages on NFS lands in R3	All gages in R3	% Gages on NFS lands in R3
Current Gages	60	365	16.4

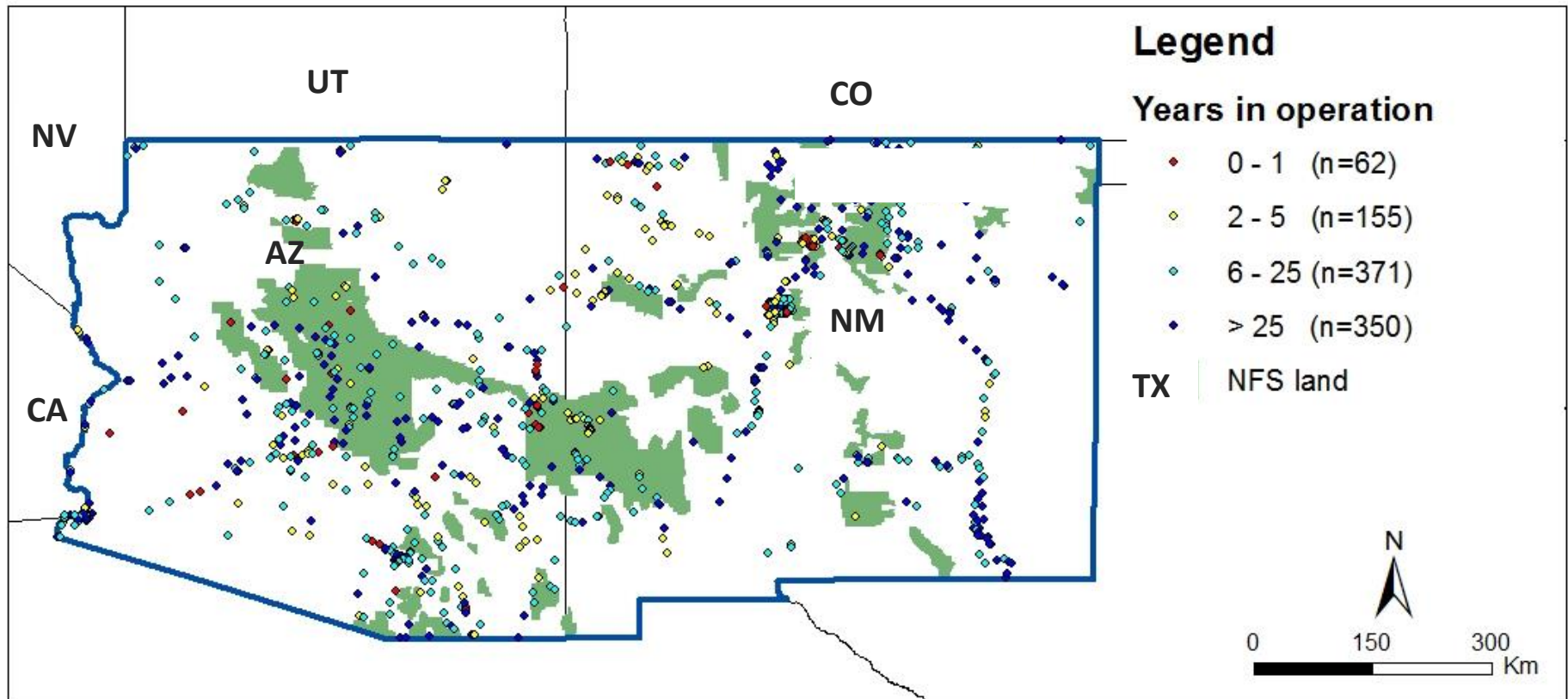
USGS Stream Gages Currently Operational: Only those on NFS Lands



	Gages on NFS lands in R3	All gages in R3	% Gages on NFS lands in R3
Current Gages	60	365	16.4

Years in Operation

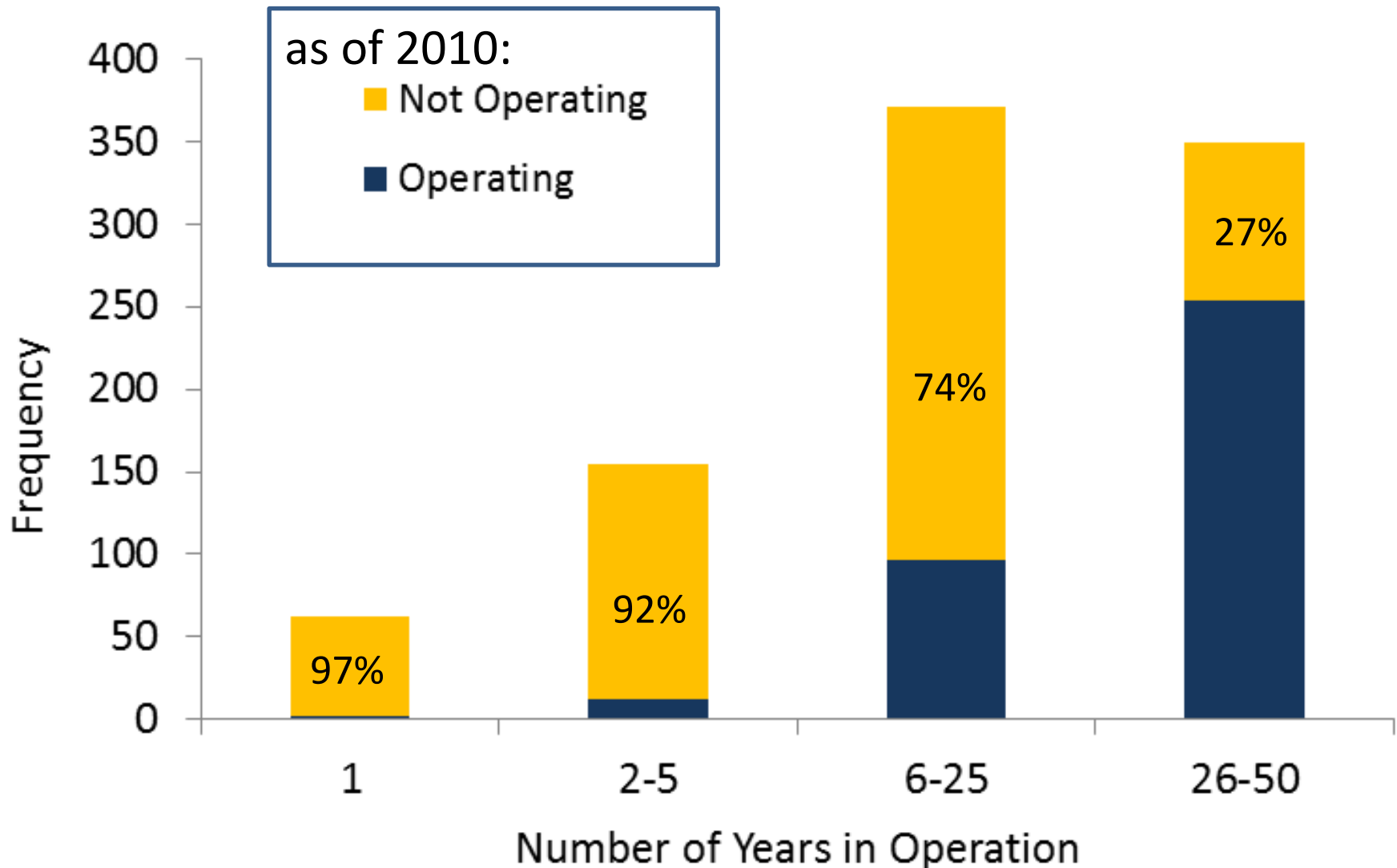
USGS Stream Gages from 1912 - 2012 (n=938)



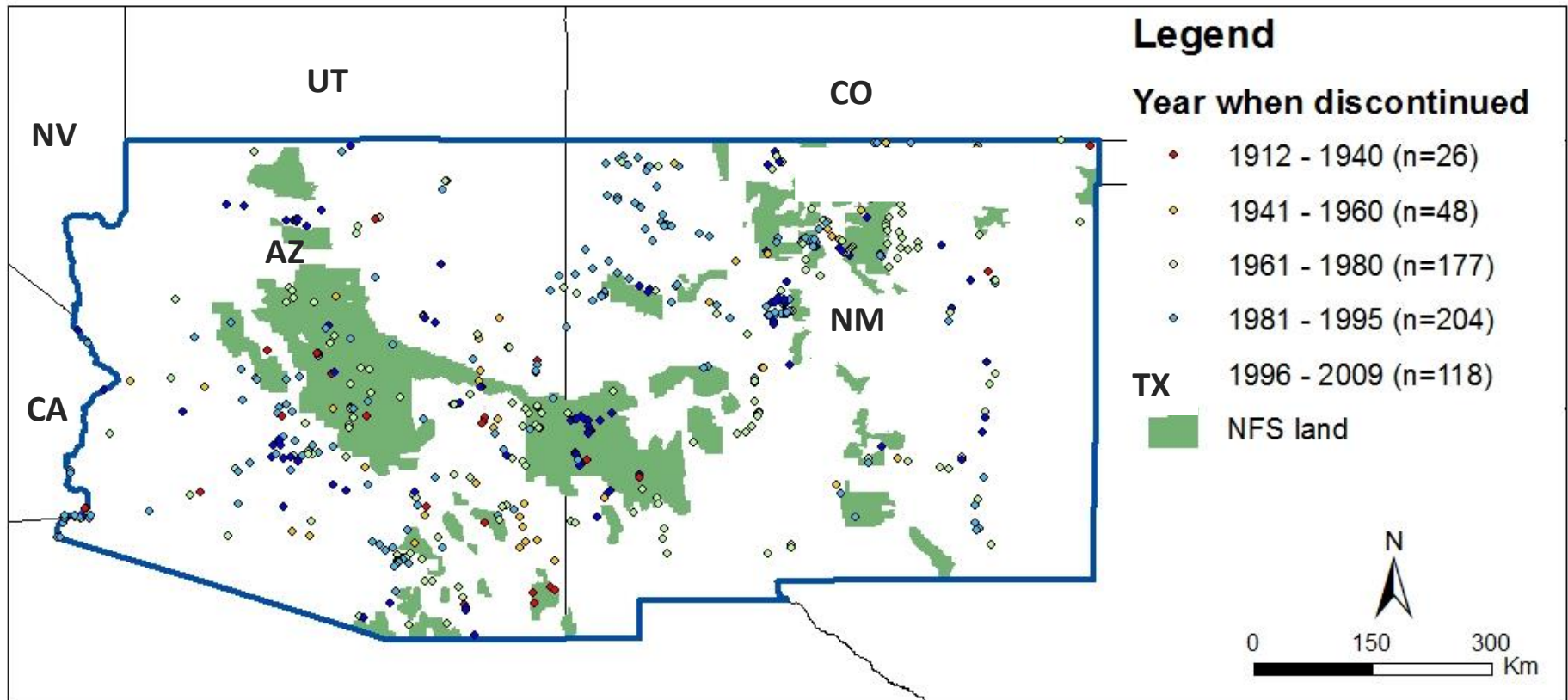
The next slide displays these data in a bar chart.

Years in Operation

USGS Stream Gages from 1912 - 2012 (n=938)



Year when Discontinued USGS Stream Gages from 1912 - 2009 (n=573)



Group 1

Stream Segments in Region 3

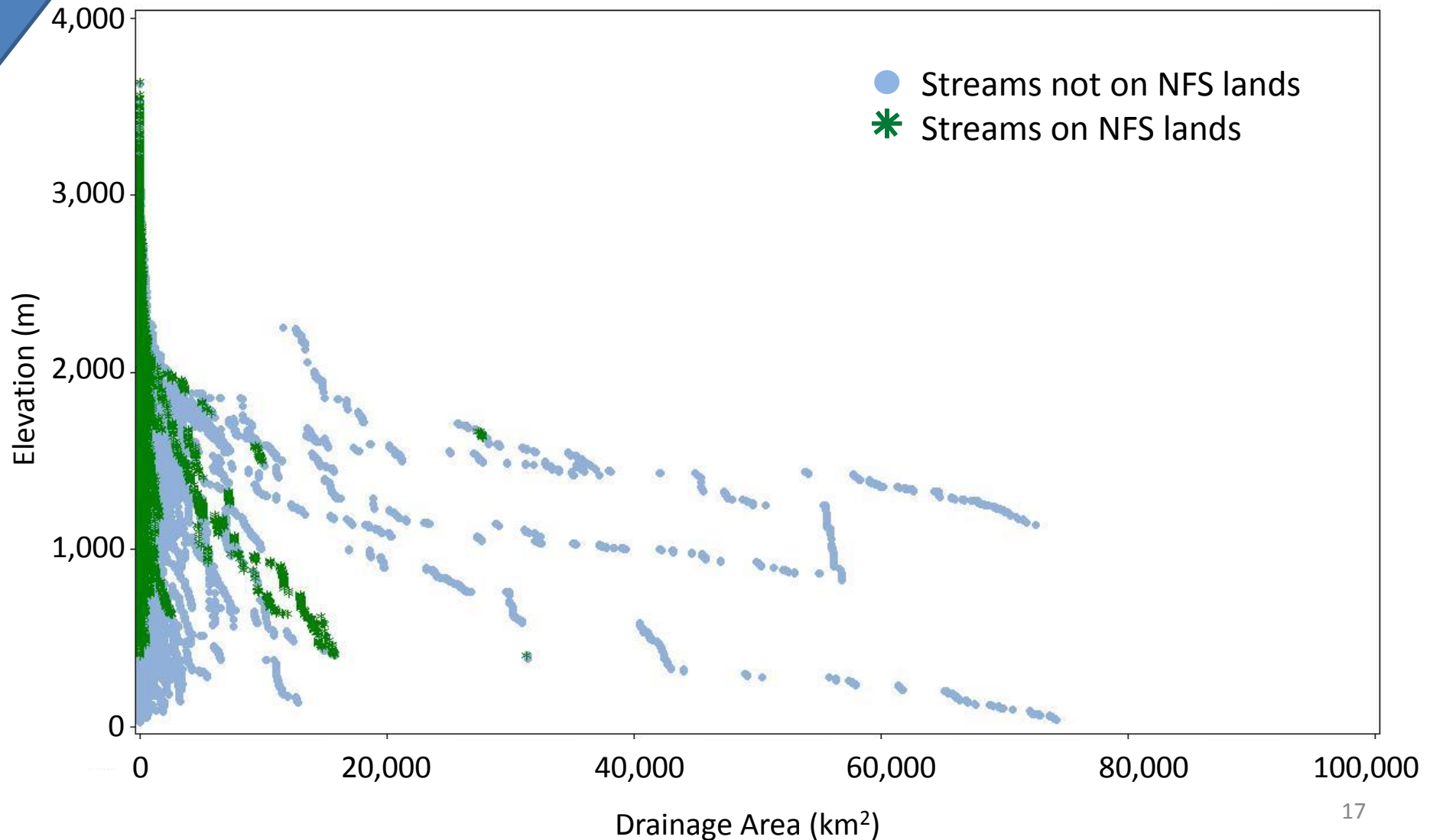
On the following 3 slides, each stream segment within Region 3 is plotted by elevation and drainage area.

Overlaid on the region's stream segments are the stream segments located on NFS lands.

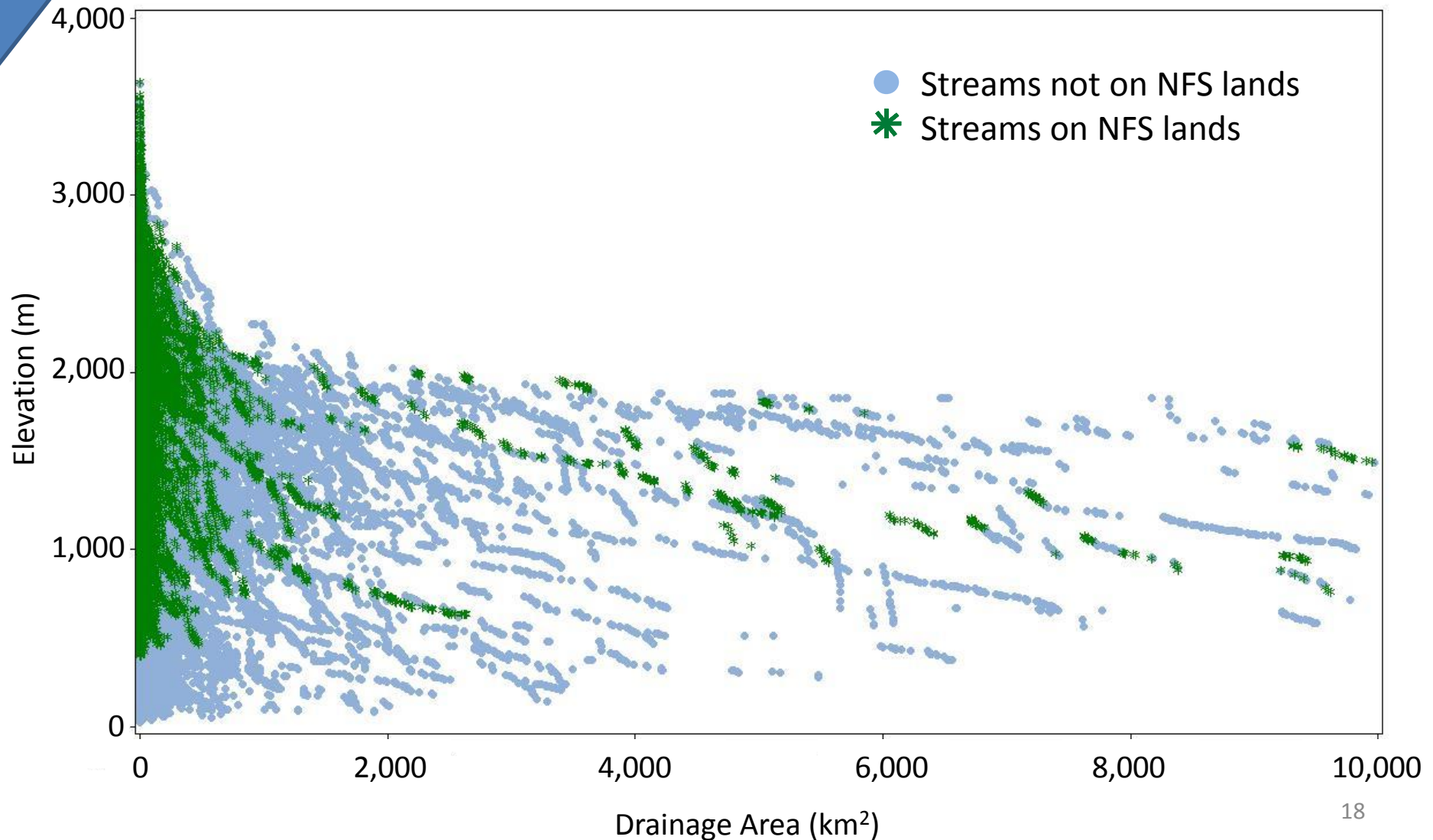
The first slide is truncated at 100,000 km² because the Ohio, Missouri, and Mississippi Rivers created a dramatically skewed plot.

The only difference between the next few slides is that for each successive slide the horizontal axis will be magnified.

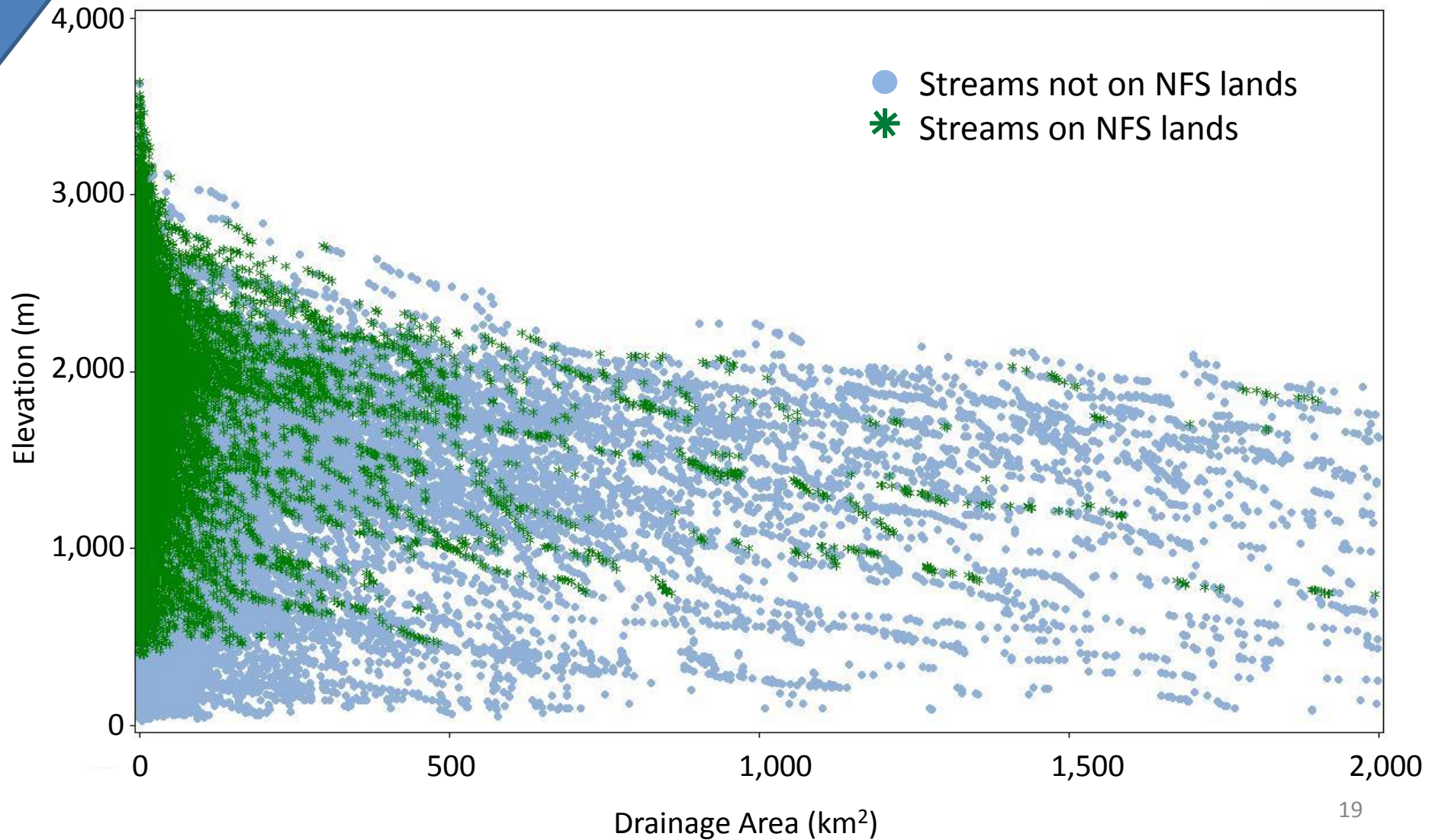
Stream Segments in Region 3



Stream Segments in Region 3



Stream Segments in Region 3



Group 2

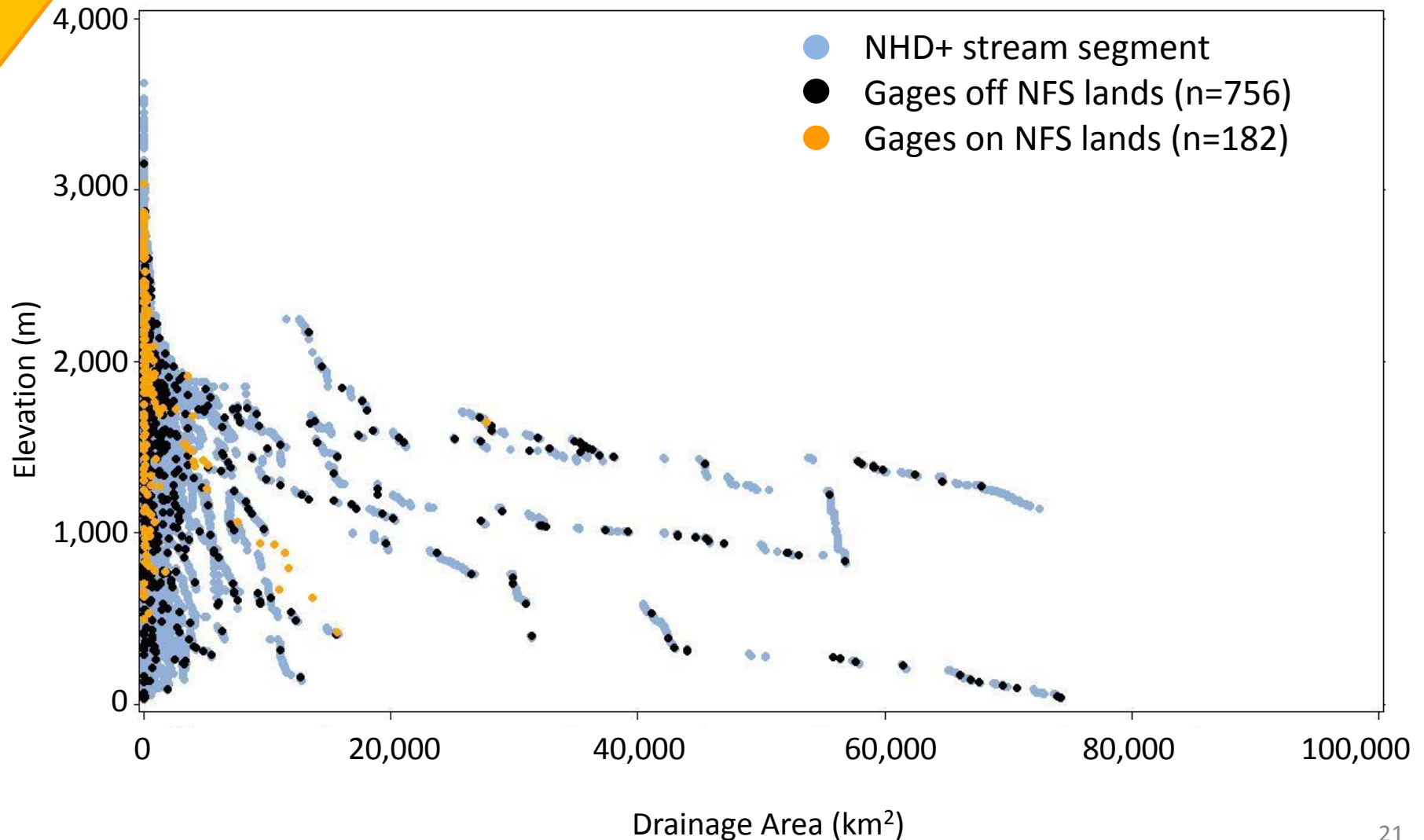
All Stream Gages - off and on NFS Lands

On the following 4 slides, each stream segment within Region 3 is plotted by elevation and drainage area (truncated at 100,000 km²).

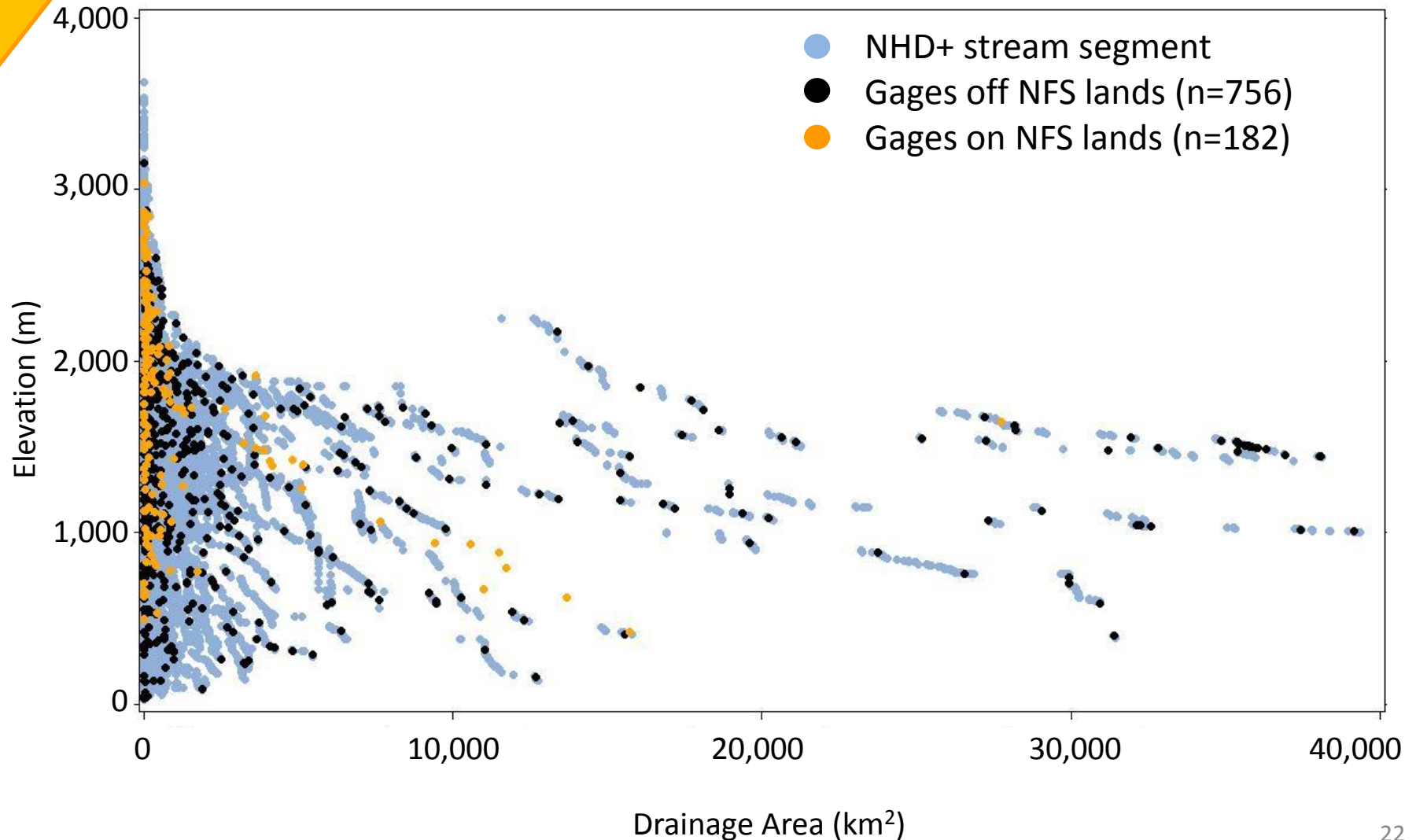
Overlaid on the stream segments are the 938 stream gages that are/were active since 1912. There are 756 gages that are not on NFS lands and 182 gages on NFS lands.

The only difference between the next few slides is that for each successive slide the horizontal axis will be magnified, as in Group 1.

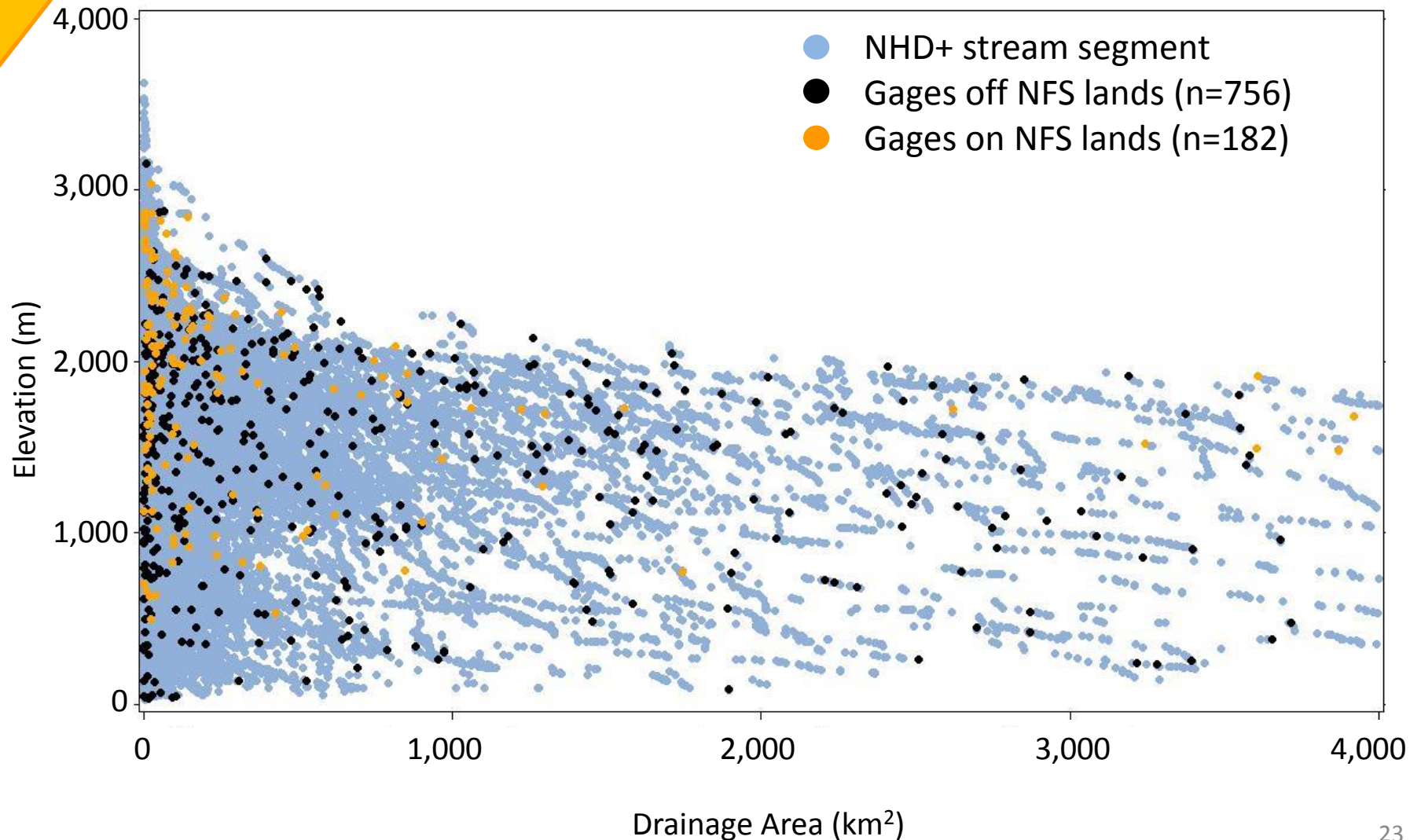
All Stream Gages - off and on NFS Lands



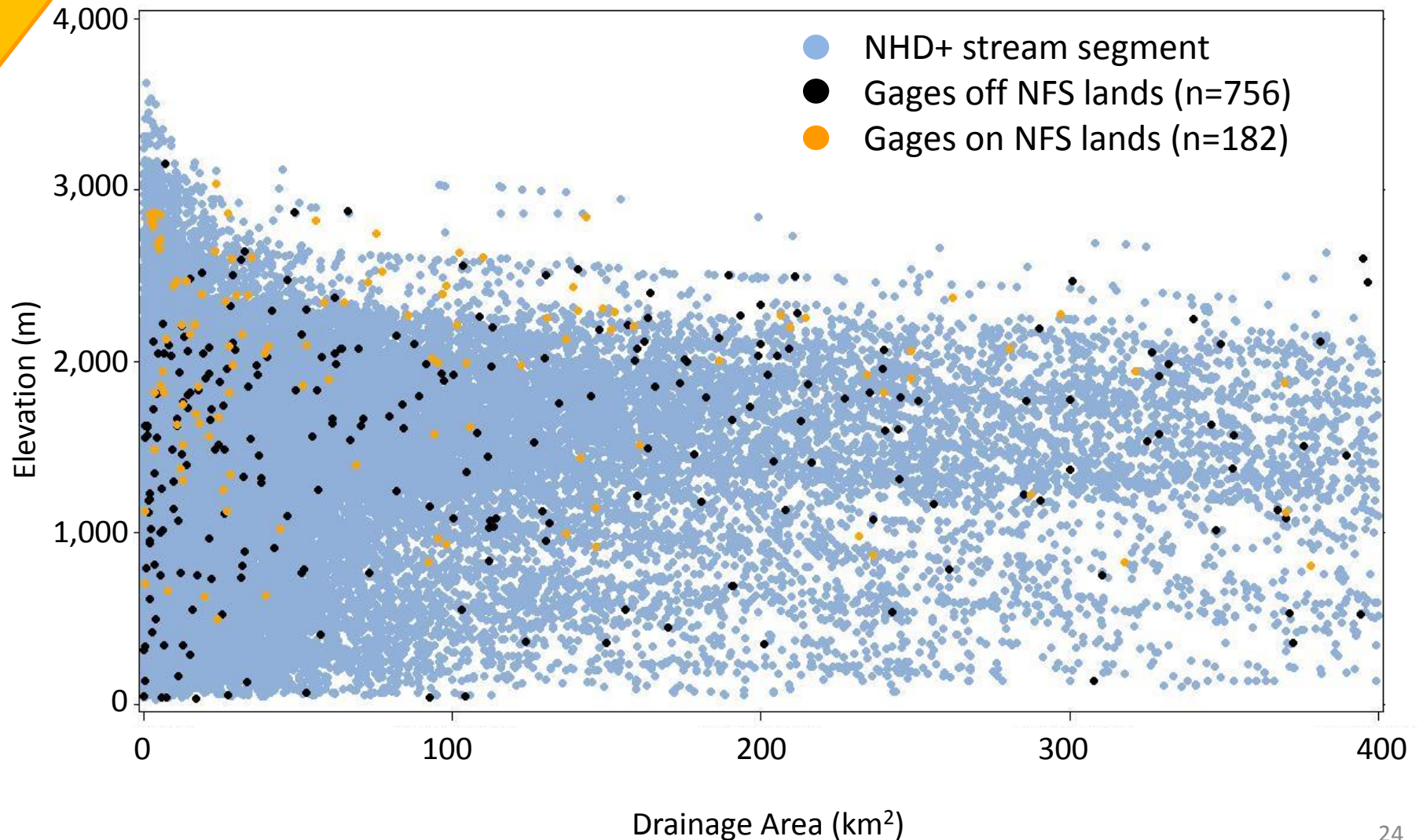
All Stream Gages - off and on NFS Lands



All Stream Gages - off and on NFS Lands



All Stream Gages - off and on NFS Lands



Group 3

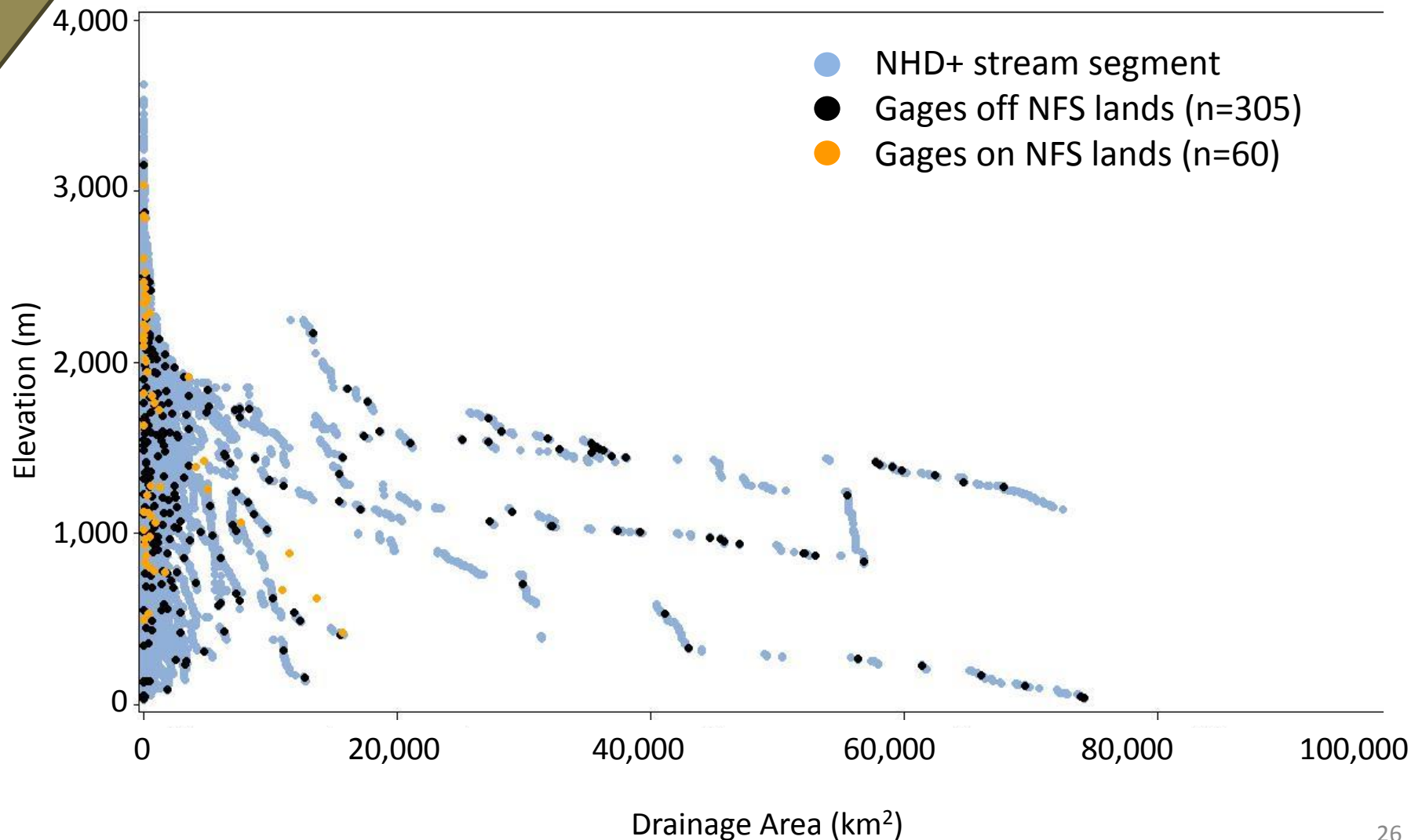
Current Stream Gages - off and on NFS Lands

On the following 3 slides, each stream segment within Region 3 is plotted by elevation and drainage area (truncated at 100,000 km²).

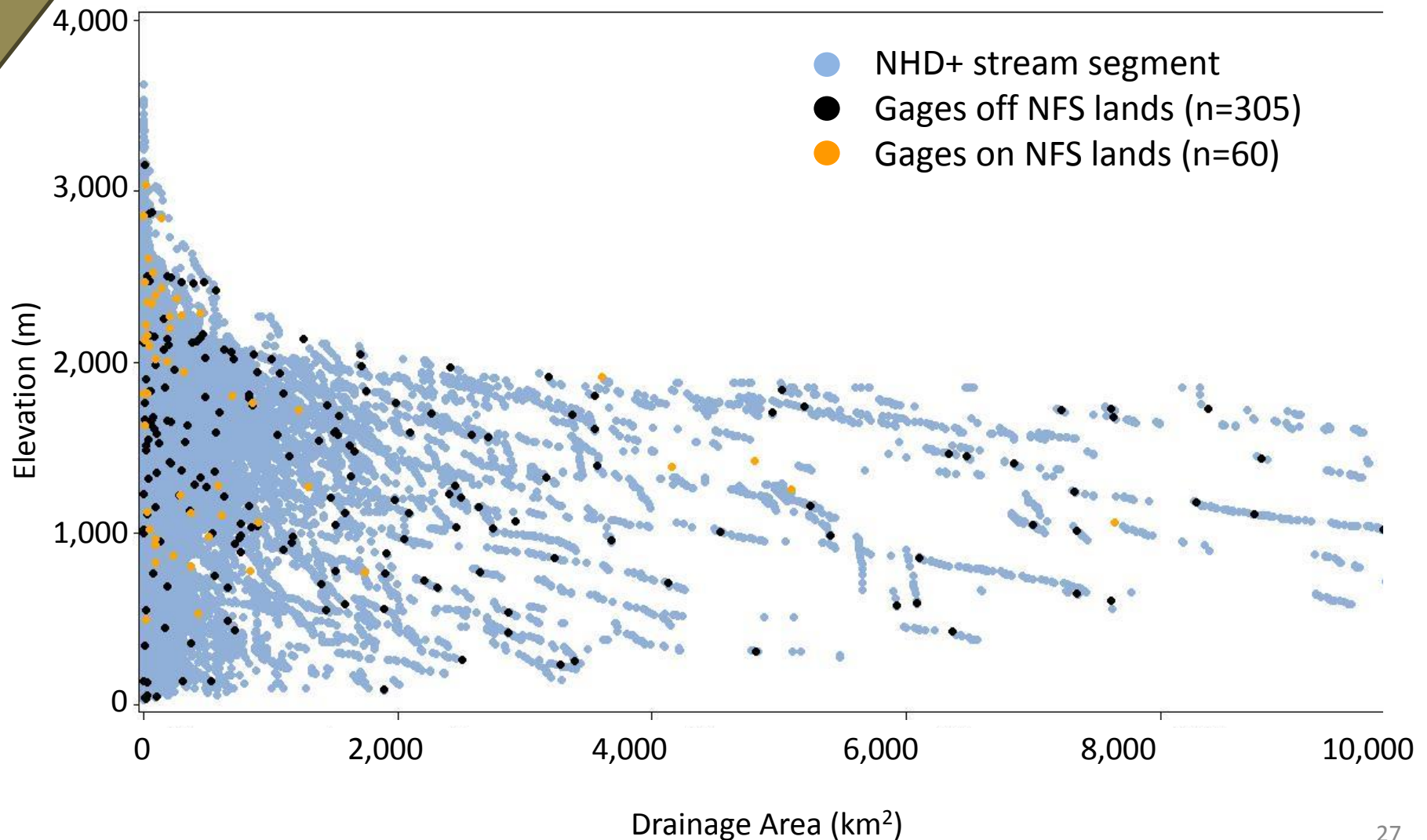
Overlaid on the stream segments are the 365 stream gages that are currently operational, as of January 2010. There are 305 gages operating off NFS lands and 60 gages on NFS lands.

The only difference between the next few slides is that for each successive slide, the horizontal axis will be magnified, as before.

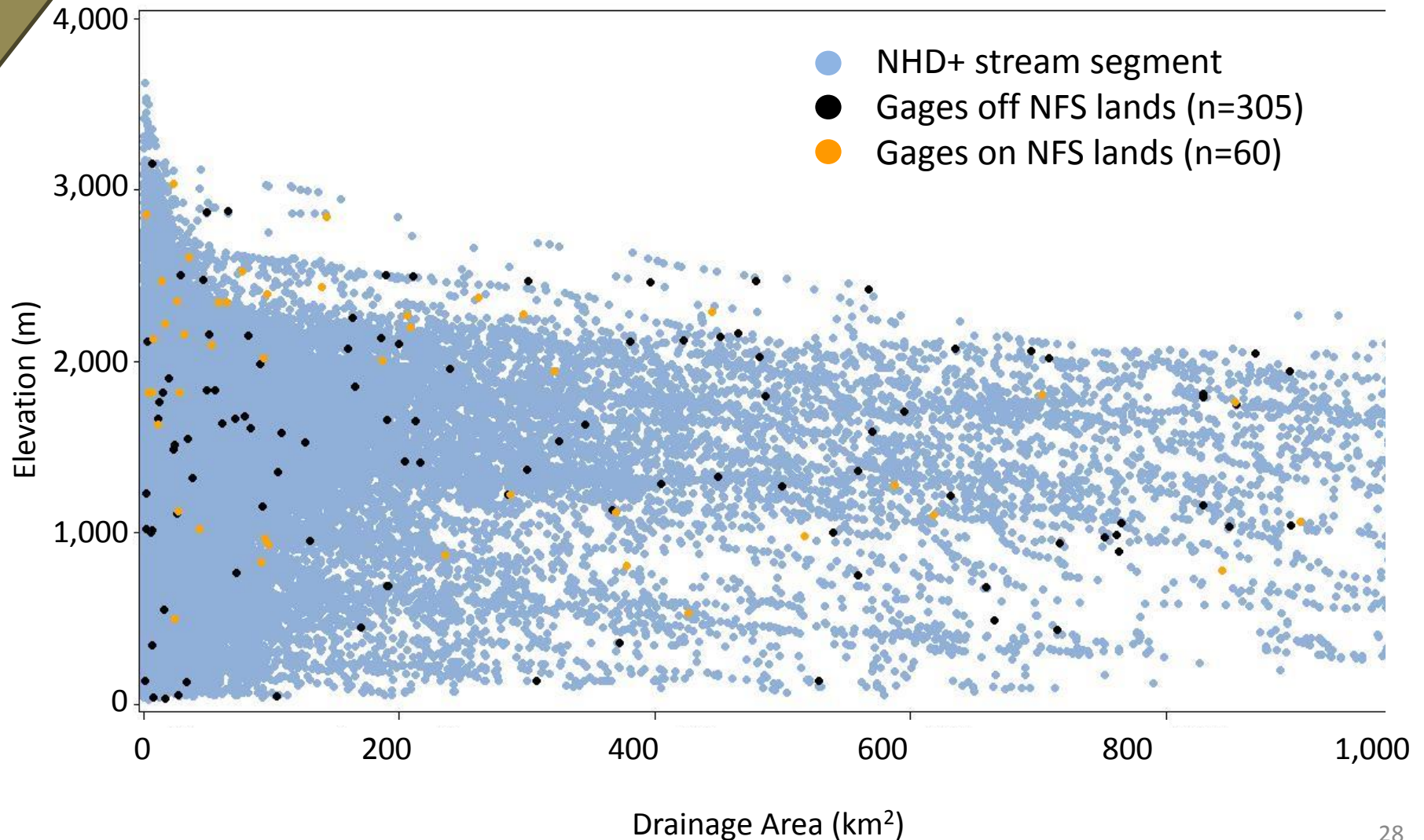
Current Stream Gages - off and on NFS Lands



Current Stream Gages - off and on NFS Lands



Current Stream Gages - off and on NFS Lands



Group 4

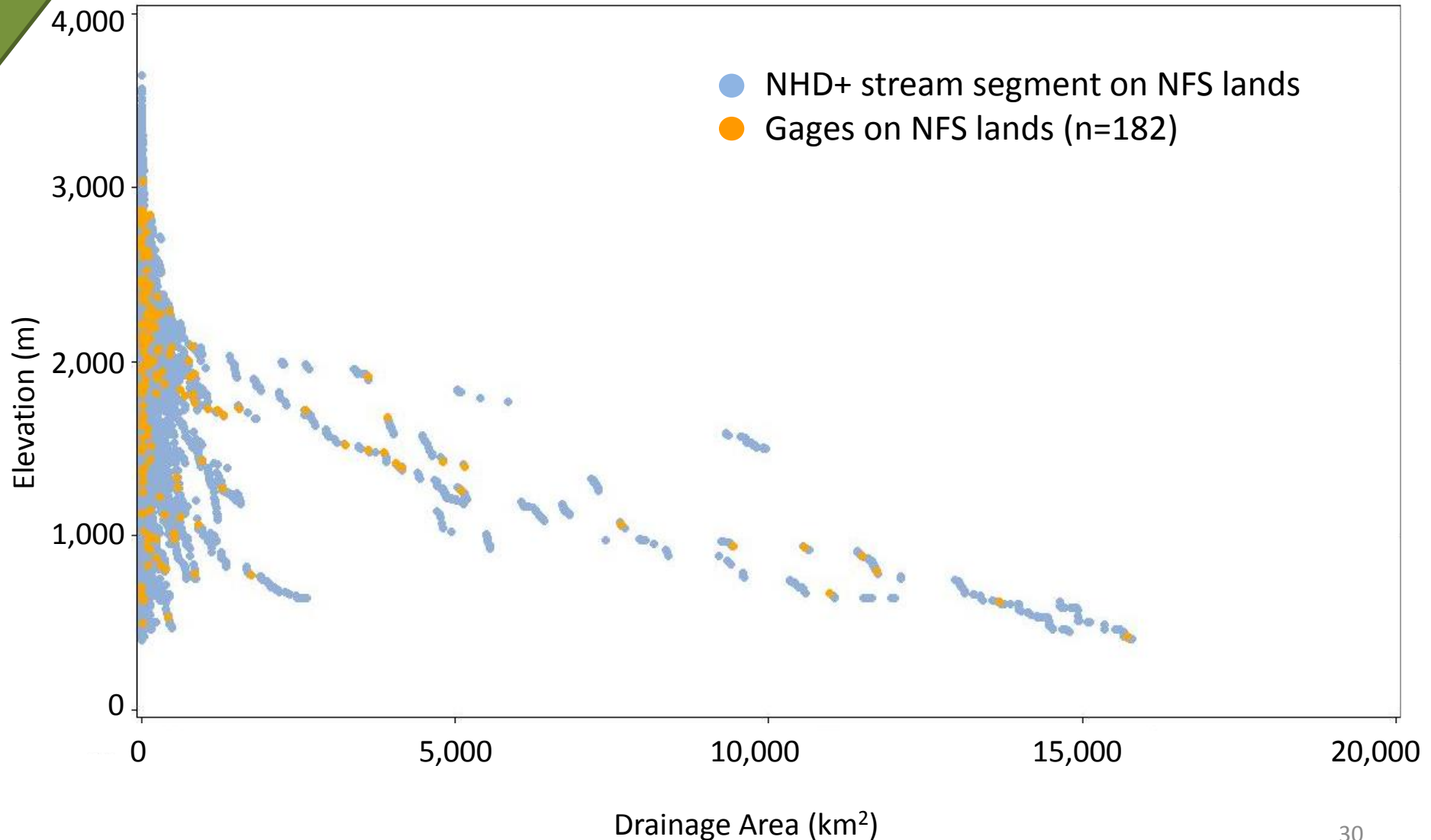
Streams and Historic Gages on NFS Lands

On the following 3 slides, we have plotted only the stream segments that are on NFS lands. Overlaid on the stream segments are 182 stream gages that are/were active since 1912.

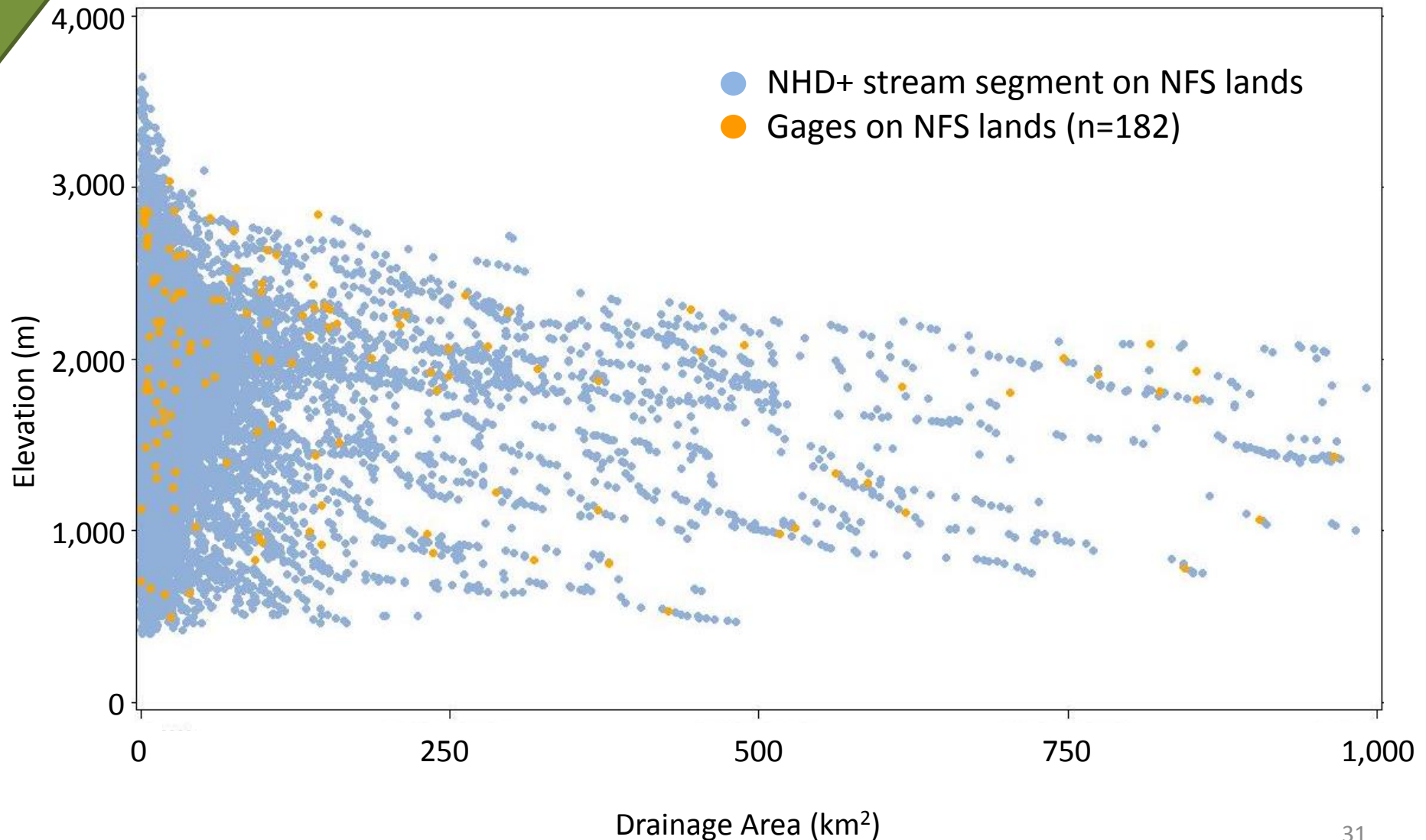
These slides allow us to see the available population of stream segments, relative to the distribution of gages that occur on the Forest, versus Group 2, which showed all stream segments in the entire region.

The only difference between the next few slides is that for each successive slide the horizontal axis will be magnified.

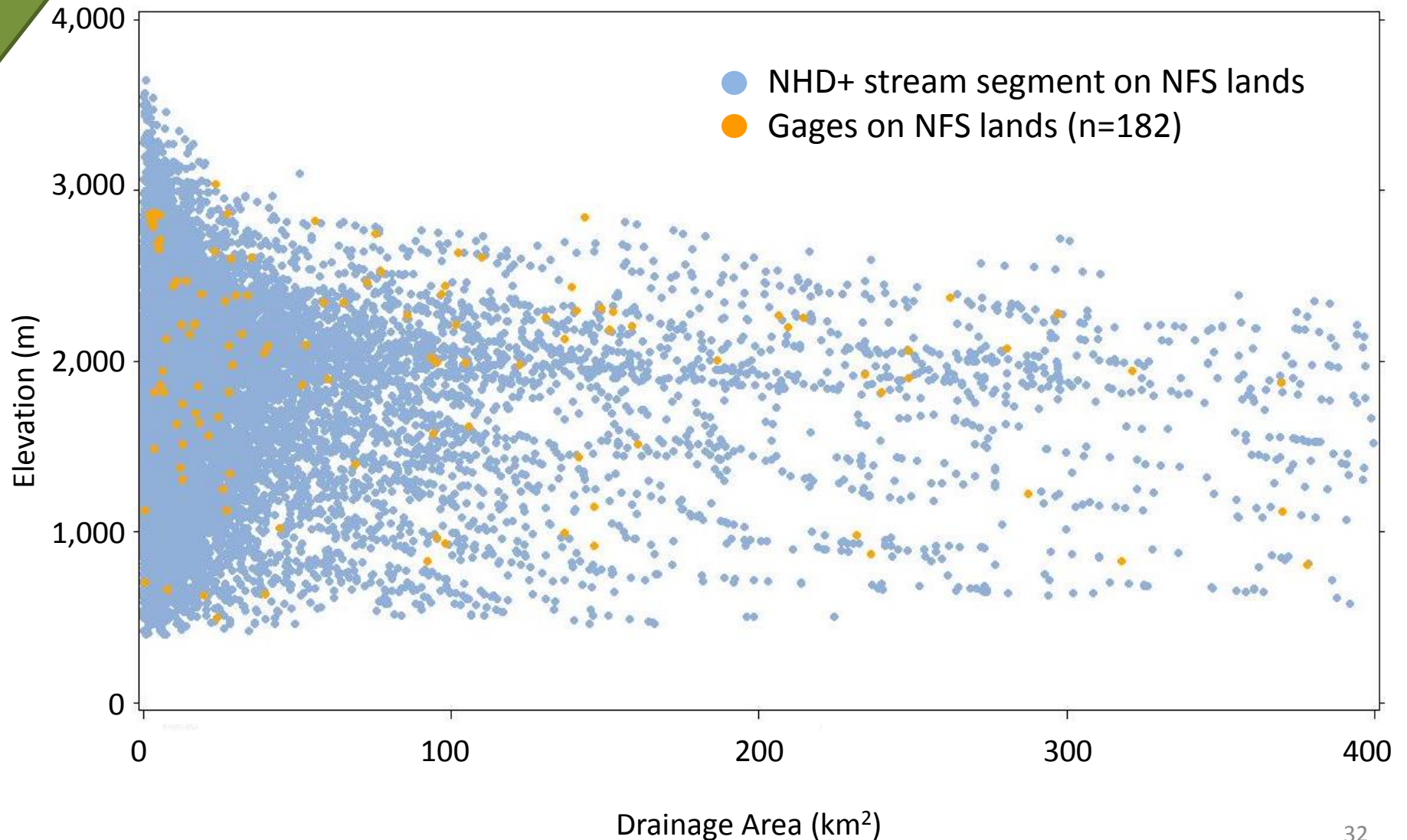
Streams and Historic Gages on NFS Lands



Streams and Historic Gages on NFS Lands



Streams and Historic Gages on NFS Lands



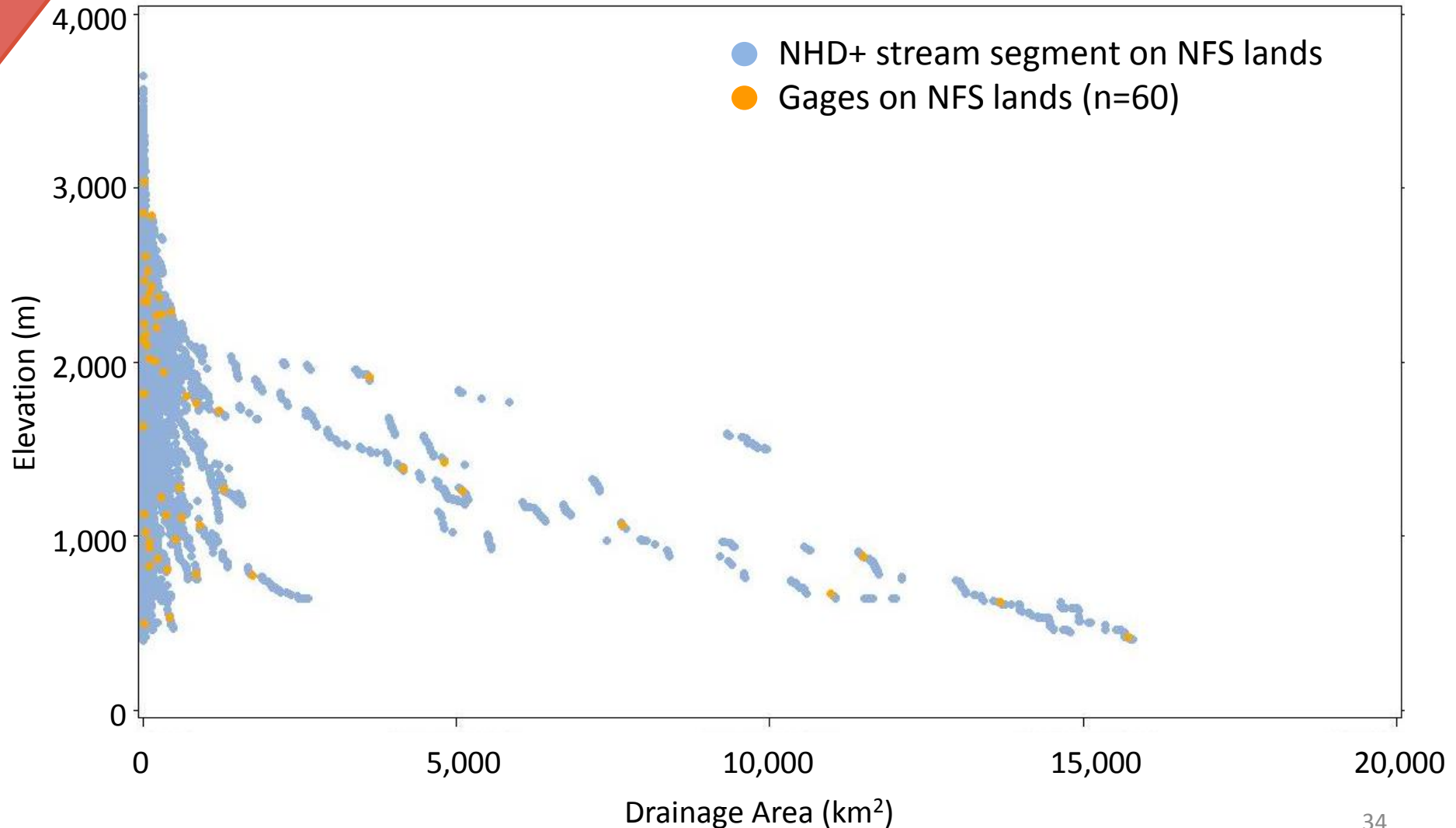
Group 5

Streams and Current Gages on NFS Lands

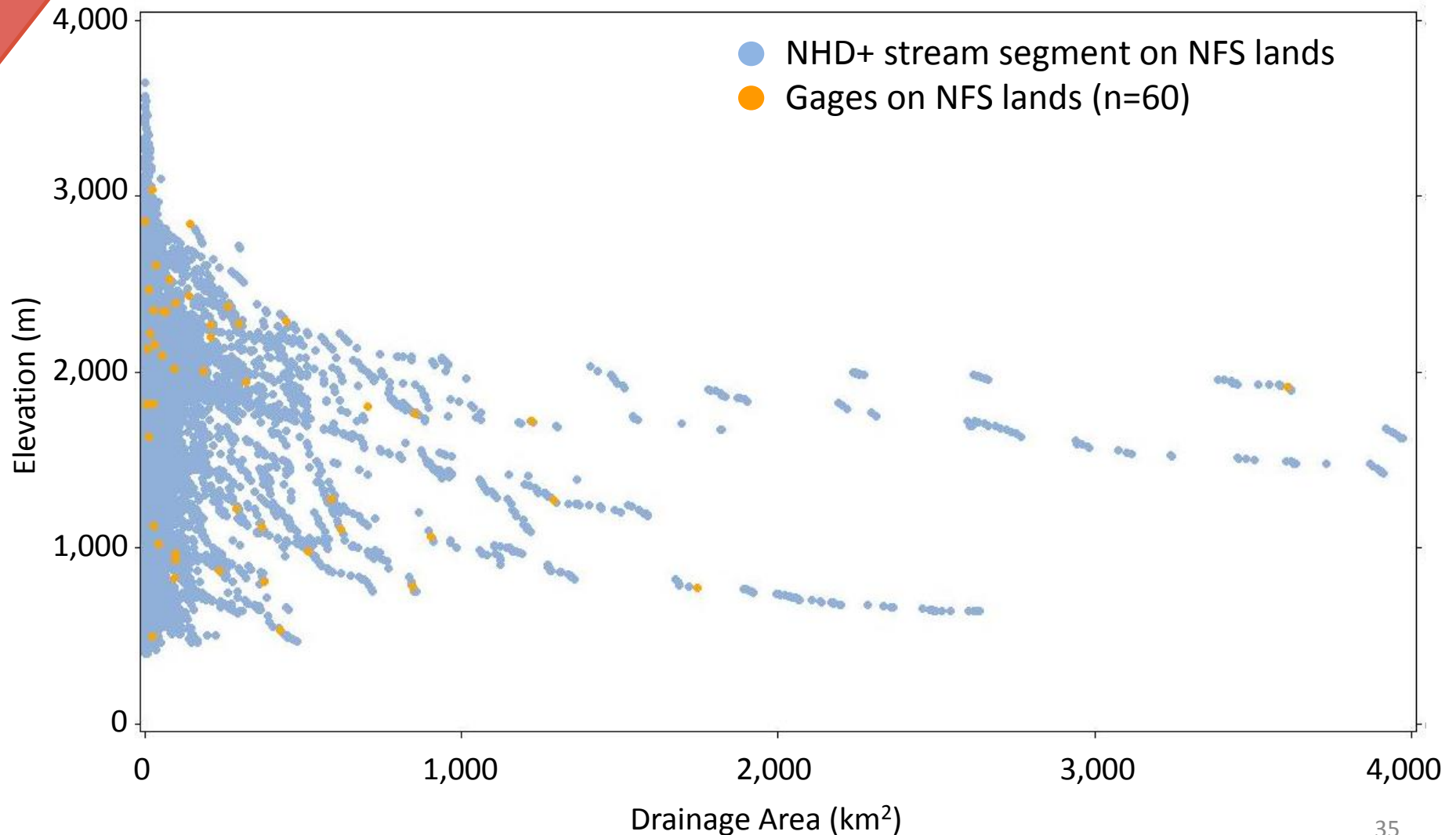
On the following 3 slides, we have plotted only stream segments that are on NFS lands. Overlaid on the stream segments are the 60 stream gages that are currently active as of January 2010.

For each successive slide the horizontal axis will be magnified.

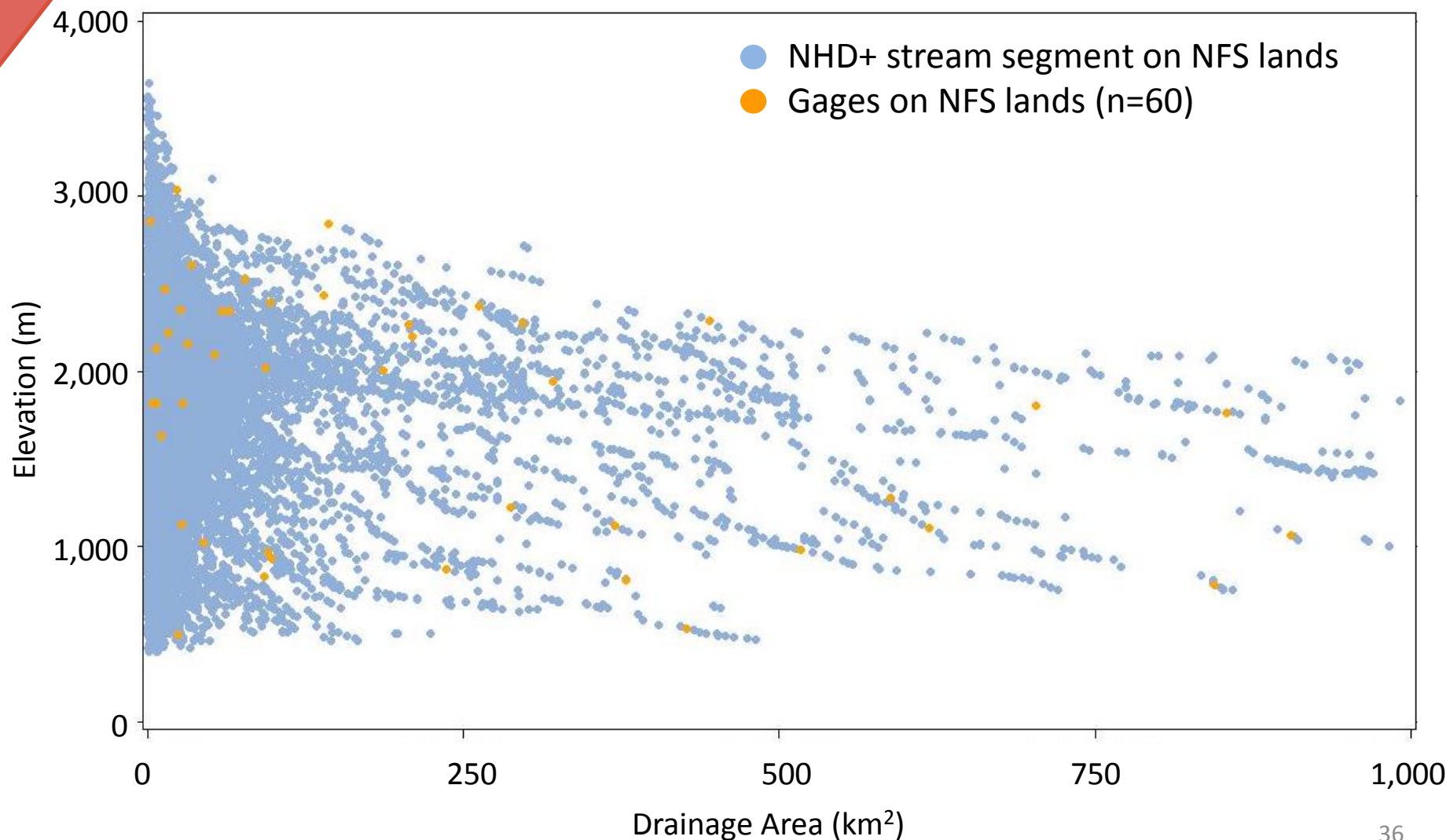
Streams and Current Gages on NFS Lands



Streams and Current Gages on NFS Lands



Streams and Current Gages on NFS Lands



Stream Gages Adjacent to NFS Lands

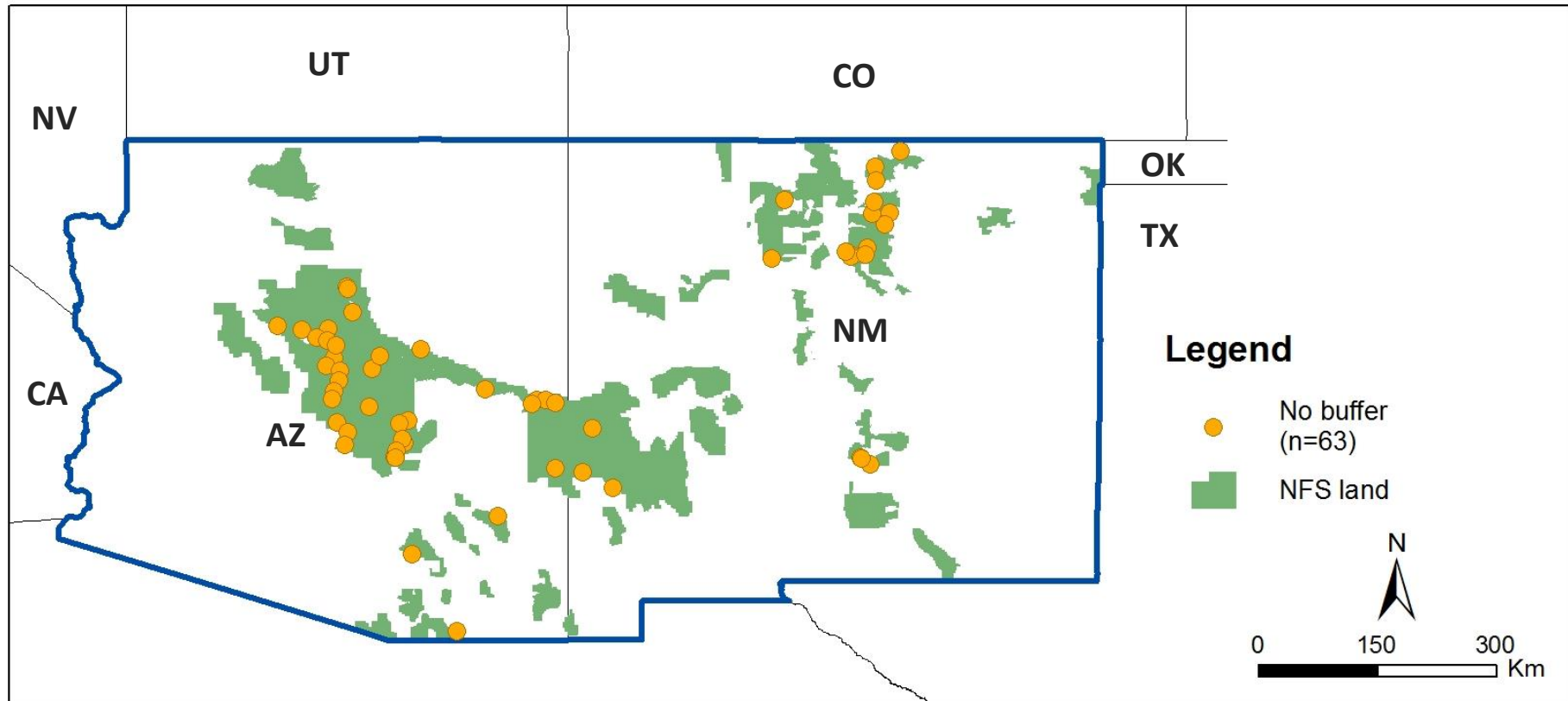
ISSUE

Many stream gages are located on waterways that are downstream of, and not on, a National Forest. In our analysis, only streams gages that touched a Forest boundary, using ArcGIS, were classified as a gage on NFS lands. This type of classification does not account for the tremendous amount of flow that influences gages immediately downstream of a Forest.

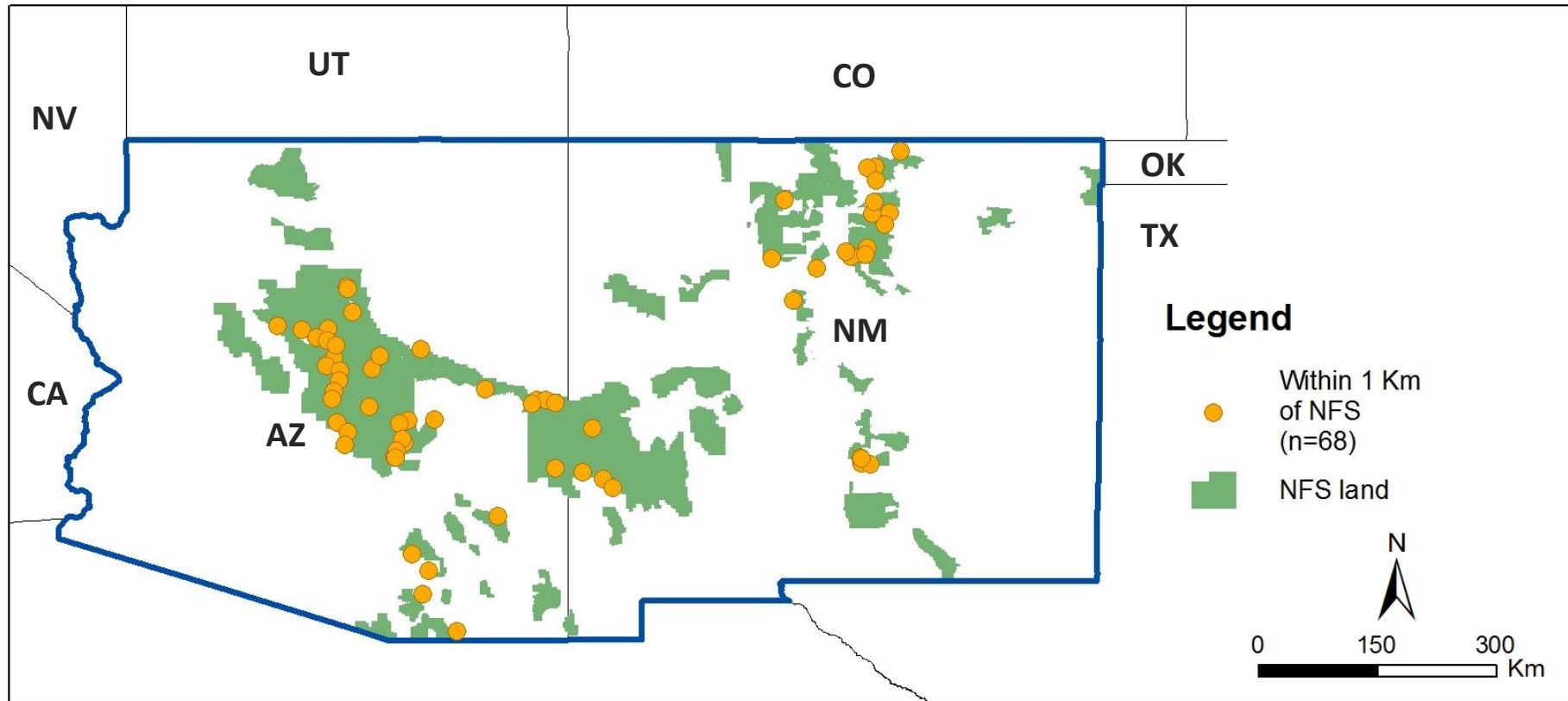
SOLUTION

On the next 6 slides we show the effect of adding a 1 Km and 10 Km buffer around the Forest boundary. We classified all gages within the buffer as being on NFS lands.

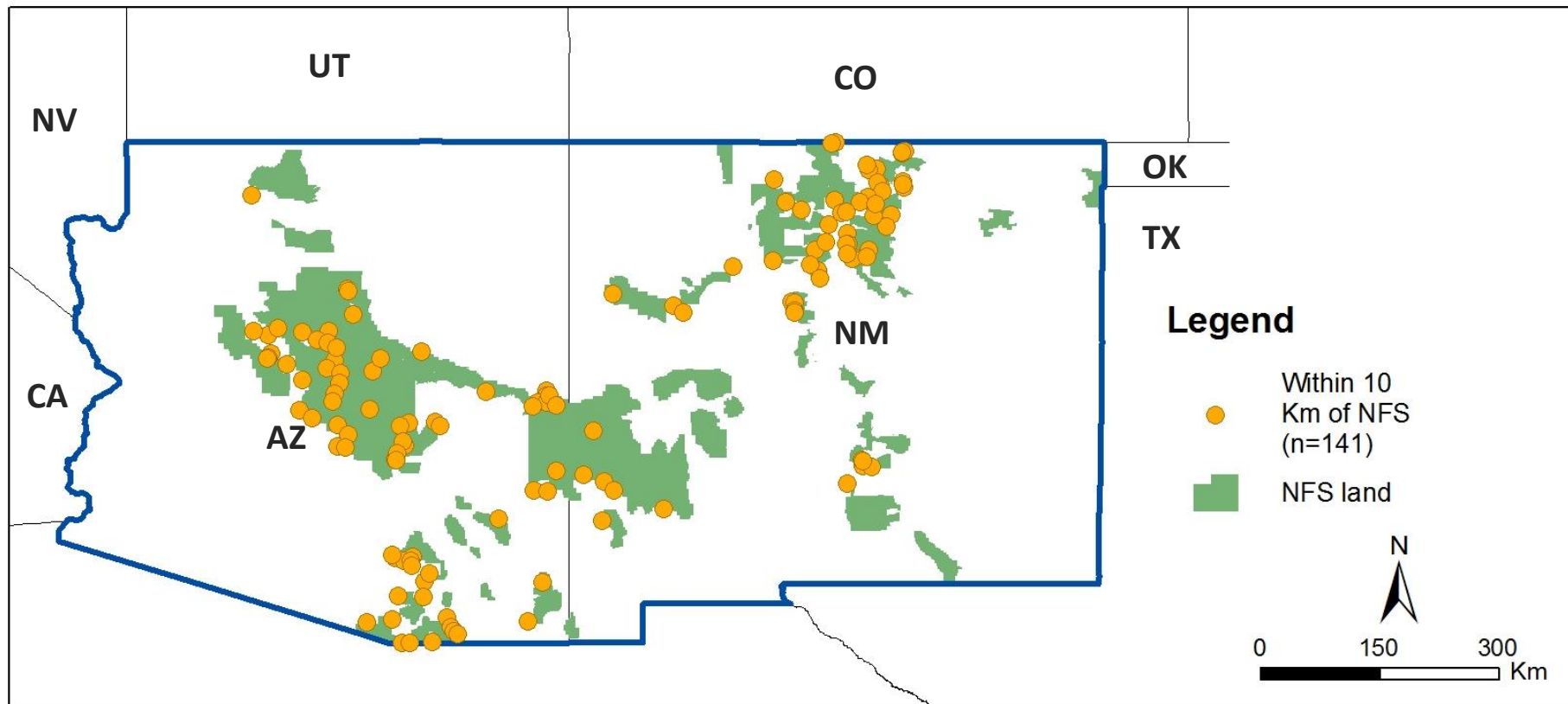
USGS Stream Gages Currently Operational: On NFS Lands - **No Buffer**



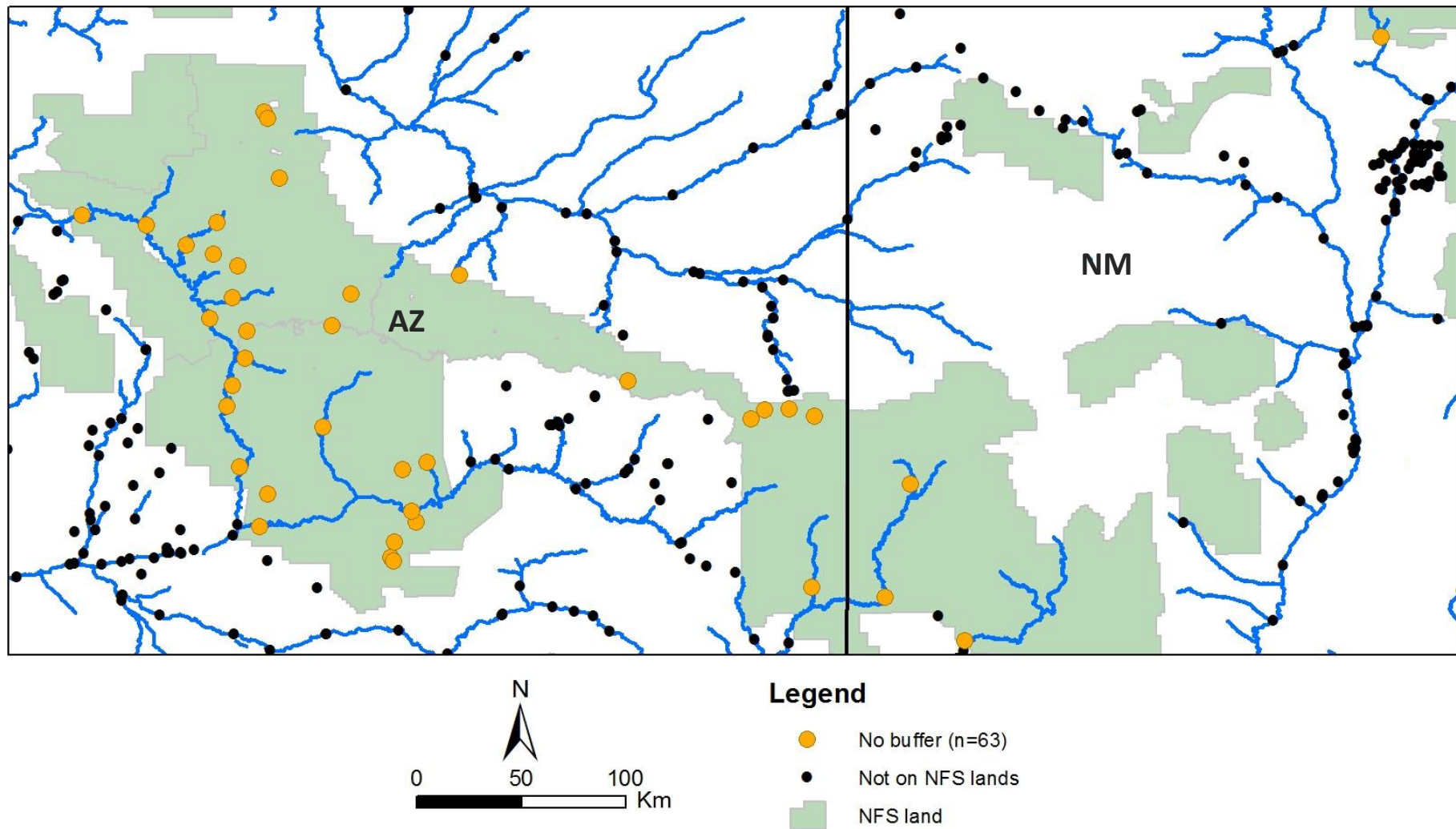
USGS Stream Gages Currently Operational: On NFS Lands - **Within 1 Km**



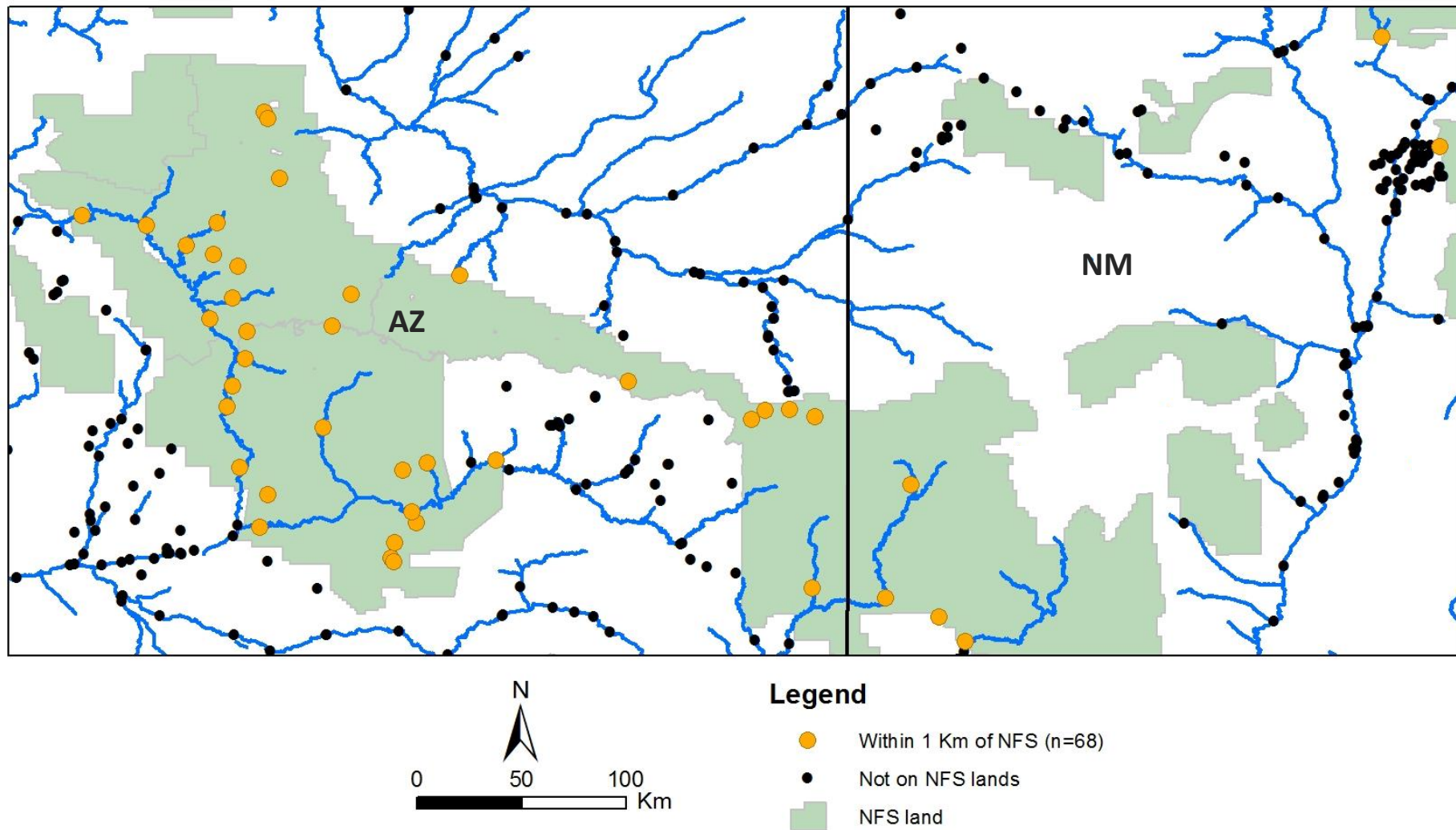
USGS Stream Gages Currently Operational: On NFS Lands - **Within 10 Km**



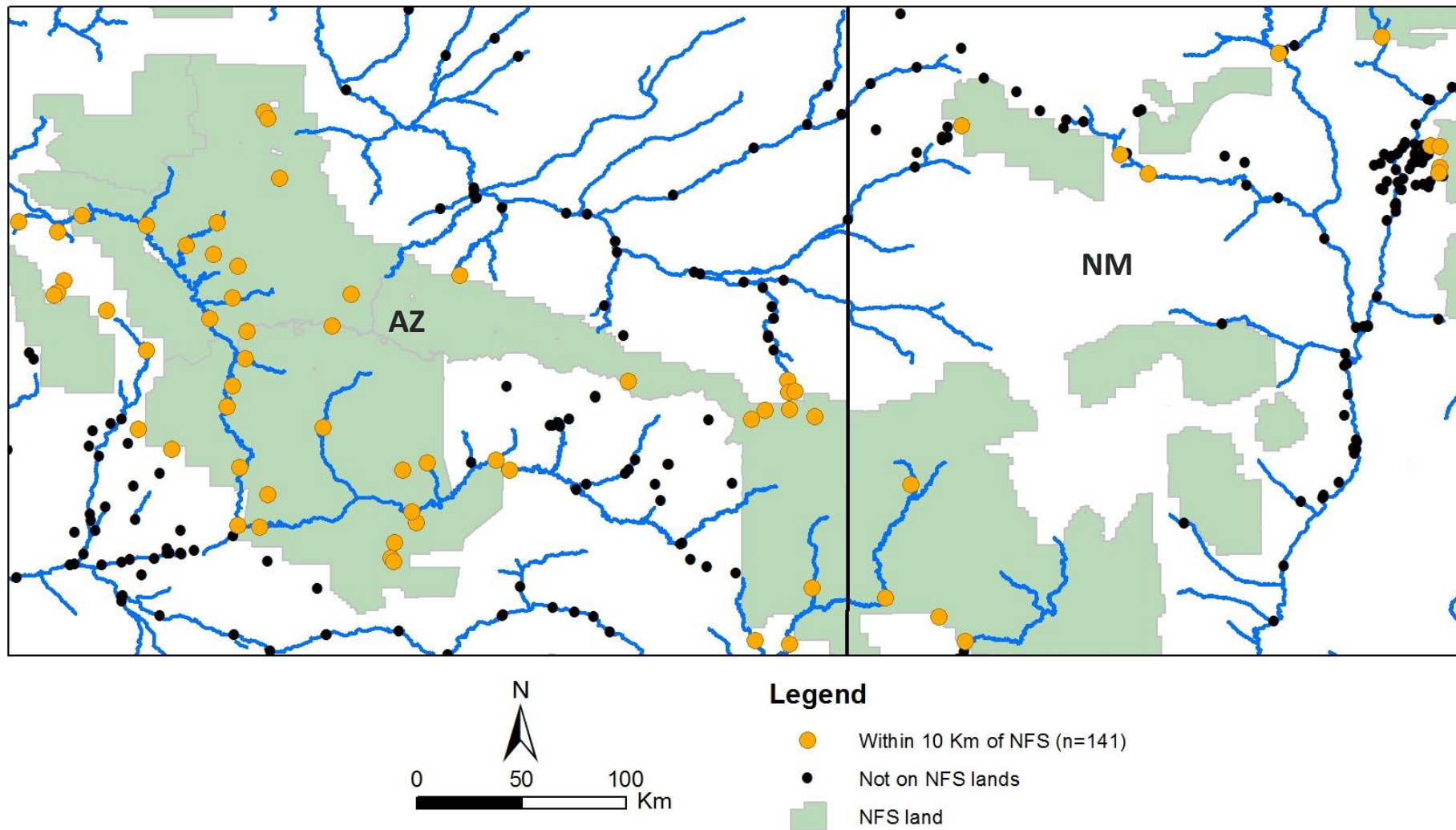
USGS Stream Gages Currently Operational: On NFS Lands - **No Buffer**



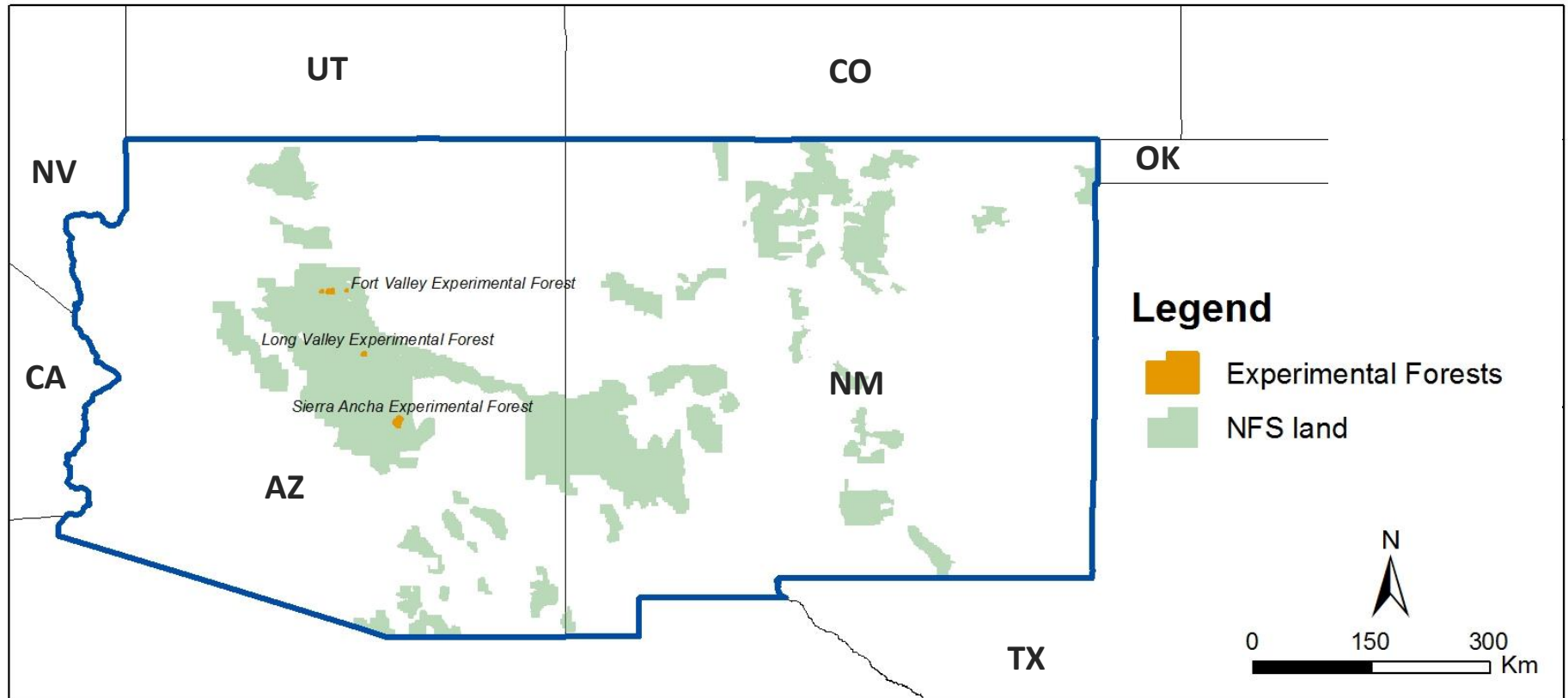
USGS Stream Gages Currently Operational: On NFS Lands - **Within 1 Km**



USGS Stream Gages Currently Operational: On NFS Lands - **Within 10 Km**



Experimental Forests in Region 3





The Embudo streamgage on the Rio Grande, N.M. has recorded over 125 years of streamflow data.